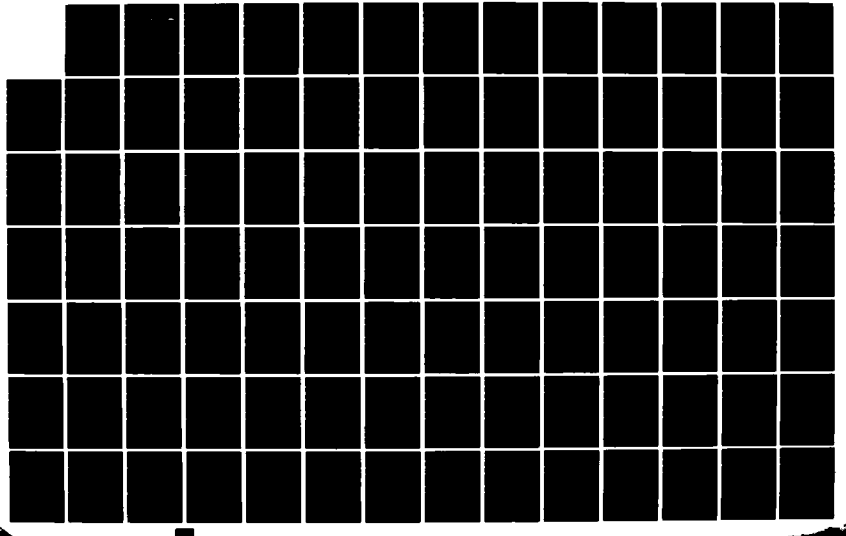
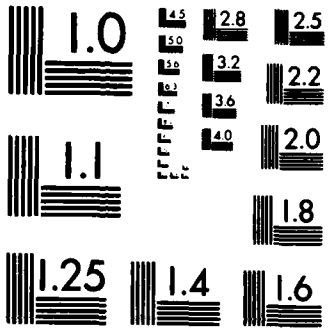
AD-A150 058 MUNICIPAL AND INDUSTRIAL NEEDS (MAIN II) ST PAUL DISTRICT REVISION(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT B CARLSON ET AL. JAN 84 1/2

UNCLASSIFIED F/G 8/8 NL





US Army Corps
of Engineers
St. Paul Distnct

MUNICIPAL AND INDUSTRIAL NEEDS (MAIN II)

St. Paul District Revision

USERS MANUAL

JANUARY 1984

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A150 058 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MUNICIPAL AND INDUSTRIAL NEEDS (MAIN II): St. Paul District revision, users manual.	5. TYPE OF REPORT & PERIOD COVERED
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Bruce Carlson, Robert Stackowiak	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St Paul, 1135 USPO & Custom House, St. Paul, MN 55101-1479	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE January 1984
	13. NUMBER OF PAGES 157 p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

WATER SUPPLIES,
WATER TREATMENT
WATER CONSERVATION,
MUNICIPALITIES

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report is a modification of the MAIN II model developed by the Institute for Water Resources. This modified MAIN II model was used to project municipal and industrial water supply demand for the city of Eau Claire, Wisconsin. It is an invaluable tool for assessing the need for water supply and treatment facilities, and is a first step in evaluating the effect of water conservation measures.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

FOREWORD

The St. Paul District, Corps of Engineers, has modified this version of MAIN II, which was originally developed by the Corps Institute for Water Resources. The modifications were made at the request of the Wisconsin Department of Natural Resources under the authority of the Water Resources Development Act of 1974, Section 22, Planning Assistance to the States, (Public Law 93-251). This modified MAIN II model was used to project municipal and industrial water supply demand for the city of Eau Claire, Wisconsin. This model is an invaluable tool in assessing the need for water supply and treatment facilities. It has also been used as a first step in evaluating the effect of water conservation measures because it supplies a base projection to which conservation measures could be applied.

This latest version of MAIN II was developed by Bruce Carlson and Robert Stackowiak of the St. Paul District. It incorporates several important improvements that are expected to broaden the usefulness of the model. First, the method of projection has been modified. An internal-growth model was replaced with a per-capita growth model as the lowest priority projection mode. This model as well as projections based on historic trends (mid-level) and externally-supplied projections (highest level) are now identified in the MAIN II output.

The process of modification also resulted in conversion to the Harris computer. The model now runs in a "batch" rather than an "interactive" mode. These changes resulted in a twenty-fold reduction in the St. Paul District's cost of running the program.

Finally, the effect of various water conservation measures can now be supplied to the model. The model will therefore provide projections of demand based on those measures.

We in the St. Paul District believe that these changes offer significant improvements in the MAIN II model that will broaden its appeal to all concerned with the issue of water supply and conservation.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDIXES

CHAPTER I: INTRODUCTION AND SUMMARY

INTRODUCTION

The MAIN II System is a tool for estimating and forecasting municipal water requirements. MAIN is an acronym for Municipal And Industrial Needs. This system is designed for the use of urban planners, water resource planners, and water utilities. It improves the ability to develop sound and realistic plans involving the supply and allocation of municipally-supplied water. The version of MAIN II described in this text is the one modified by the U.S. Army Corps of Engineers, St. Paul District, in 1983.

The MAIN II System is a flexible planning tool. Water requirements for a study area are estimated separately for the residential, commercial/institutional, industrial, and public/unaccounted sectors. Within these sectors, requirements are further estimated for individual categories of water users, such as metered-sewered residences, flat rate-sewered residences, commercial establishments, institutions, three-digit Standard Industrial Classification (S.I.C.) manufacturing categories or individual manufacturers. Estimates are made of mean annual, maximum-day, and peak-hour water-use requirements. These features not only assure greatly improved information about the nature of future water demands, but they also permit the final estimate to be responsive to changes in the mix of water-using activities that occur in the growth of metropolitan areas. Water requirements can be estimated for current and projection years.

Research performed by The Johns Hopkins University, as well as data gathered by the Bureau of the Census, American Water Works Association, Hittman Associates, Inc., and other groups, has resulted in a series of

mathematical models of water requirements that permit the MAIN II System to accurately estimate water demands in the various categories as a function of specified water-use parameters. These water-use parameters include factors such as home value, persons per household, retail floor space, and industrial employment in each three-digit (S.I.C.) category. Users of the MAIN II System can provide detailed local data when these data are easily obtainable, and the users can rely on data collected and condensed from national samples when local data are difficult to obtain.

Forecasts of water requirements result from projecting the value of the water-use parameters by a variety of methods. The MAIN II System user can tailor the operation of the system to a specific community and select a separate projection method for each category.

This report describes the MAIN II System in sufficient detail to permit its application to a specific local forecasting effort. The MAIN II System computer program and the Library of Water Usage Coefficients are also described in detail. Examples of data preparation and output reports are given. This report also contains data regarding required computer characteristics and the specifications of the MAIN II System computer program and library magnetic tapes. The MAIN II System has been designed and the user's manual has been written so that the user needs little training or experience with computers.

MUNICIPAL DATA SOURCES

The municipal data requirements of the MAIN II System consist of a series of data subgroups related to the residential, commercial/institutional, industrial, and public/unaccounted sectors of the community. The data required are values of a number of economic and demographic parameters that have been found to be closely related to water use. The parameters are to be evaluated at a base year, or as close to that base year as

possible. When the MAIN II System is used to estimate current water requirements, the estimate will be for the base year used in data gathering. When the projection capability is utilized, all projections will be calculated from the base year.

The following sections discuss some of the information that is be used to obtain water-use estimates with the MAIN II System. Chapter II lists the exact requirements for each subgroup. A summary of information sources that are available in most communities and that may be useful in assembling the required data is in figure 1.

Source	Type of Information or Data
Local Public Library	General reference source
Regional or Local Planning Office	General advice and suggestions
Department of Public Works	General advice and suggestions
Chamber of Commerce	General advice and suggestions
U.S. Census Bureau "Block Statistics"	Many residential parameters
Board of Election Supervisors	Population distribution
Water Supply Utility	Water rates (prices) and jurisdiction
Real Estate Board	Housing and apartment data
Department of Assessment	Property values
Bureau of Building Inspectors	Residential data, office buildings, and retail space
Department of Correction	Prison population
Department of Education	School and college enrollment
Department of Health	Data for barber shops, beauty shops, restaurants, bars, hotels, motels, hospitals, and nursing homes
Council of Churches	Church membership
Blue Cross	Data for hospitals and nursing homes
Board of Liquor License Commissioners	Data for bars, nightclubs, and taverns
Barber Schools	Barber shop data
Beautician Schools	Beauty shop data
American Petroleum Institute	Gas station data
Restaurant Chains	Conventional and drive-in restaurant data
Movie Theatre Chains	Theatre and drive-in movie data
Bus and Rail Depots	Transportation terminal size

Figure 1. Typical Sources of Parameter Data **(Continued on next page)**

Source	Type of Information or Data
Car Wash Equipment Suppliers	Data on car washes
Bowling Equipment Suppliers	Data on bowling alleys
Laundry Suppliers	Data for commercial laundries
Laundry Equipment Suppliers	Laundromat data
YMCA Type Facilities	Data for YMCA, YWCA, etc.
U.S. Census Bureau "Census of Business"	Many commercial parameters
Department of Employment Security	Office, retail, and industrial employees by S.I.C. number
U.S. Census Bureau "Census of Manufacturers"	Industrial populations
U.S. Department of Commerce, Bureau of the Census Statistical Abstract of the United States	Municipal Identification Data, Construction Cost Indices, other data for SMSA and States

Figure 1. Typical Sources of Parameter Data (Concluded)

Municipal Identification Data

These data consist of such information as the name of the urban area, the latitude and longitude of the area in degrees, population of the community, and other data. The MAIN II System uses this information in such ways as identification on the printed reports, interpolation of climatic data, and computing public/unaccounted usages.

Residential Data

The residential segment of an urban area is divided into four categories or groups, each of which is subdivided still further. The categories are designated by the method in which the residents pay their water bills (metered or flat rate) and the method of waste disposal (public sewer or septic tank). The MAIN II System uses categories made up of combinations of these functions: metered and sewered, metered and septic tank, flat rate and sewered, and flat rate and septic tank.

The system assumes that people living in apartments who do not pay a water bill will use water at a different rate from homeowners. Therefore, apartments should be classified in the commercial category, with each apartment considered a separate housing unit, provided that they are not individually metered.

Within each of these subcategories, the residences should be grouped into home-value ranges. (Value of an apartment is the value of the apartment building divided by the number of units in the building.) This value may be the retail market value (including land and building) or the assessed property value. In the latter case, an assessment factor must be obtained from the tax assessor's office.

The following parameters are needed for each home-value range: the number of dwelling units, the housing density in terms of dwelling units per acre of residential land (including streets), population density in terms of average number of persons per dwelling unit, and the annual average price of water and the summer price of water (both in cents per 1,000 gallons).

One convenient way to find the categories and subgroups of home value is by political subdivisions. The U.S. Bureau of the Census has maps of every major metropolitan area in the United States showing census wards and tracts. Often, the values of the homes within each of these political subdivisions are all nearly the same, and the housing density is fairly uniform. A MAIN II System user could acquire these Census Bureau maps and use them to locate the subcategory areas. The maps can also be planimetered to determine actual residential land area.

Some metropolitan areas are serviced by more than one water supply facility with different rate structures. The jurisdictional boundary limits of these suppliers should be indicated on the maps to properly assign water-use prices to the subcategories and value-range groupings.

The system user may find the data needed on values of residences in the tax assessor's files. A possible source of data on population distribution might be the Board of Election Supervisors. The Census Bureau issues block statistics reports on major metropolitan areas but only for the years of the census. These reports contain all data except prices that can be used by the residential submodel of the MAIN II System.

Commercial and Institutional Data

The commercial and institutional segment of a community is subdivided into categories of commercial and institutional establishments. The user needs to collect (or estimate) values of appropriate water-use parameters for each of the categories such as the number of barber chairs in all the barber shop for the study area, the number of hospital beds in all the hospitals, and similar information.

The MAIN II System has a built-in set of 28 general-purpose commercial and institutional categories. A complete list of these categories is in chapter II. The system has space for an additional 22 unassigned commercial categories that are available to the user.

Values for commercial and institutional parameters may be acquired from various local municipal agencies and from major central commercial organizations and suppliers. Examples of municipal agencies that might have data are Department of Education, Department of Health, Department of Correction, Fire Department, Liquor Board, Planning Office, Bureau of Building Inspectors, and similar agencies. The user may find additional commercial parameter data from these central business sources: Chamber of Commerce; American Petroleum Institute; wholesale distributors of supplies and equipment for bowling centers, laundries, car washes, movies, barber shops, beauty shops, and restaurants; the Council of Churches; transportation terminals; and the local yellow pages directory. The U.S. Census Bureau report on "Census of Business - Selected Services Area Statistics" also contains data that the user may find useful in estimating parameter values when data from other sources are not available.

Industrial Data

The MAIN II System has been designed to allow the user to separate the industrial segment of the community by type of industry. These industrial (manufacturing) categories are grouped by three-digit S.I.C. (Standard Industrial Classification) codes. A list of the categories that are built into the system with water-usage coefficients is in chapter II.

To use this part of the MAIN II System, the user need only find the total number of employees in each three-digit S.I.C. category. This information is usually compiled by the local office of the Department of Employment Security. There are also Census Bureau reports on "Census of Manufacturers - Location of Manufacturing Plants..." that may be useful for approximating industrial populations.

The user may also wish to organize industrial sector data by individual industry, rather than by S.I.C. category, if water-utility records are available and if actual-use parameters can be found. Changes in the library can be made to accommodate this type of organization.

Public/Unaccounted Data

The MAIN II System contains two public water-use categories (free service and airports) and one unaccounted category (distribution losses, such as leaks and breaks in the system and unmeasured use). Water use is computed with per-capita-use coefficients where the municipal population is the parameter used for free service and distribution losses, and where the average daily airport passenger count is the parameter for the airports.

The user is not restricted to accepting the system's computations for public/unaccounted use. Instead of per-capita-use coefficients, the user may input actual gallons-per-day use values for the categories where these values are known.

The system also contains space for 27 additional unassigned categories if the user wishes a further breakdown of measured free service such as street cleaning, firefighting, zoos, museums, parks, municipal buildings, and other categories.

PROJECTION DATA SOURCES

Tne use of the MAIN II System for forecasting water requirements entails the preparation of projection data. These data define the basic assumptions upon which the projection will be made. The data described previously creates the base for the projection, but the projection data determine the manner in which the projection will be carried out. Data for three kinds of projections may be prepared:

1. Per capita growth of parameters (default option)
2. Extrapolation of historical trends
3. Externally-provided projections

Projection values may be obtained from local planning agencies or developed by the MAIN II System user. Certain projections, such as population, are available from the published sources for many areas. Other projections, such as manufacturing employment, are available from the National Planning Association reports or from the business entities themselves.

Further specifications of projection data are discussed in chapter II.

LIBRARY INPUT

As mentioned earlier, part of the MAIN II System is the Library of Water Usage Coefficients, which is delivered to the user on a magnetic tape. This library contains such data as the residential equation constants, climatic data, category identification labels, and use coefficients for the commercial/institutional, industrial, and public/unaccounted submodels.

A complete detailed description of the library contents and use is in chapter III of this report. A list of the library contents is in appendix B.

CHAPTER II: DATA PREPARATION

This chapter discusses procedures for preparation of the data used in the MAIN II System. It discusses specific formats required to use the current-year, projection, and conservation simulation modes.

The input data for each mode of the MAIN II System consist of a series of data subgroups. Each data subgroup is preceded by a subgroup name card and followed by an ENDD card. Data within a subgroup may be in any convenient order, except when specified otherwise. Similarly, the subgroups themselves may be arranged in any convenient order, with the following exceptions:

1. All municipal current-year data must precede the first NEWYEAR projection data subgroup.

2. All projection subgroups must follow the NEWYEAR subgroup for which they are intended.

3. Subgroup or data identification names for which no data is listed should not be used in the input file.

CARD TYPES AND INPUT FORMAT

General input formats for the subgroup name card and data card are listed below in figure 2. The subgroup name card is used to identify groups of data, and the data cards are used to store the parameter values. Actual subgroup name and data identification labels used in the MAIN II System are listed in the following sections.

Subgroup Name Card Format

Card Column No.	Item
1	blank
2-9	subgroup name
10	blank
11-80	any remarks the user wishes to use

Data Card Format

Card Column No.	Item
1	blank
2-5	data identification name
6	blank
7-22	data field
23	blank
24-27	data identification name
28	blank
29-44	data field
45	blank
46-49	data identification name
50	blank
51-66	data field
67	blank
68-80	any user comments

Figure 2. Subgroup Name Card and Data Card Formats

As indicated above, the data card may contain up to three data identification names with corresponding values in the data field. For each number, the user must include the decimal point in the proper place.

MUNICIPAL DATA

The subgroup name card for municipal identification data follows:

CITYDATA

The name of the study area must immediately follow the subgroup name card CITYDATA. The study name area may be placed anywhere (centered, if desired) between columns 2 and 25, inclusive.

example: Eau Claire, Wisconsin
example: Fond du Lac

Other data identification names required in the subgroup CITYDATA are:

CDAT: Calendar year of current parameter values provided. This value is used as the base year for all forecasts.

LATD: Latitude (in degrees) of urban area being studied. This value is required by the system to extract climatic data from the library.

LONG: Longitude (in degrees) of urban area being studied. This value is required by the system to extract climatic data from the library.

POPU: Population of study area in base year (CDAT). This value is required for all forecasts and for computation of

public/unaccounted requirements. It may be deleted when no forecasts are to be made and no public/unaccounted results are required.

A code sheet showing sample OPTIONS and CITYDATA subgroups is in figure 3.

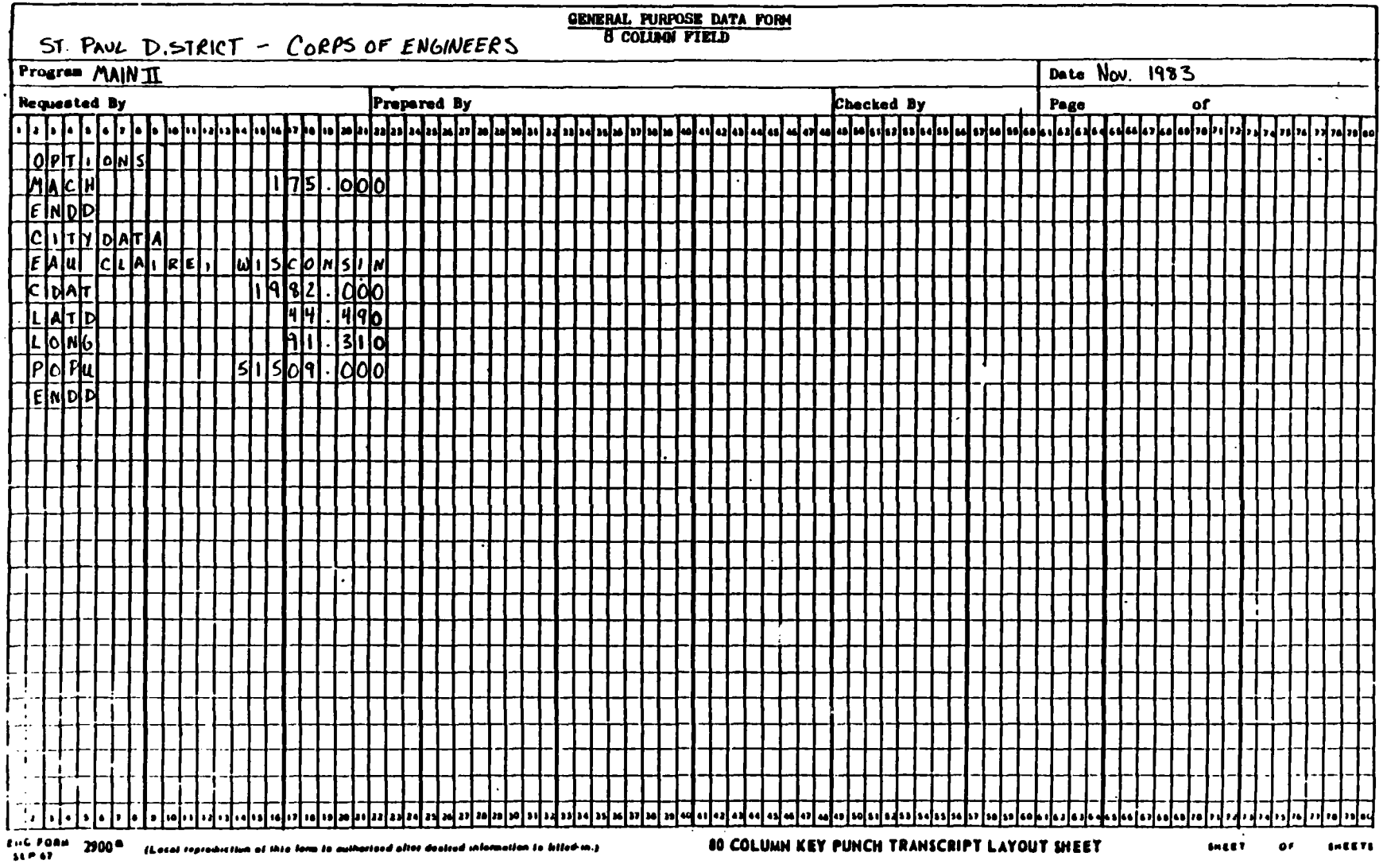


Figure 3. Sample OPTIONS and CITY DATA Subgroups

CURRENT YEAR DATA

The MAIN II System disaggregates water use into four sectors: residential, commercial/institutional, industrial, and public/unaccounted. Each of these four sectors, in turn, is broken down into more specific use categories. The subgroup and data identification names used to calculate current-year use are listed in this section.

Residential Sector

Current-year data describing the residential sector of the study area may be prepared under any of four subgroups, as required:

FLATSEPT
FLATSEWR
METRSEPT
METRSEWR

The subgroup names have the following meanings: FLATSEPT - flat rate-septic tank areas, FLATSEWR - flat rate-sewered areas, METRSEPT - metered-septic tank areas, and METRSEWR - metered-sewered areas.

Each subgroup consists of the subgroup name card, followed by data cards included in a series of value ranges, a summary card, and an ENDD card. Each value range begins with a VALN card, followed by data cards required for the given subgroup (listed below), and it ends with a VALX card. The summary card follows the last value range and includes the data identification names LOWV, MEDV, and HIGH.

The data identification names for residential parameters in each value range are defined below.

VALN: Lower limit of a property value range, expressed in dollars. This value may be assessed or market value, provided that the ASMT (see below) value is correct.

VALX: Upper limit of property value range, expressed in dollars, either assessed or market value.

ANPR: Marginal price of water, including any charges billed on the water bill as a percentage of water price, which is paid by consumers in a value group on a year-round basis. This value is expressed as cents per 1,000 gallons. It can be determined as the total charge on the water bill caused by the last 1,000 gallons purchased, i.e., the billing rate in the highest block being used, including sewer or other charges when they are a percentage of the water rate. This value may be different for each value range and is required for METRSEPT and METRSEWR only.

ASMT: Assessment factor (ratio of assessed value to current market value). The user should provide this quantity when assessed property values are used instead of market values. If the quantity is not provided, a value of 1 is assumed. A different value may be used for each value range.

DENS: Housing density expressed in dwelling units per residential acre, including streets. This value may be different for each value range.

NUMB: Number of occupied housing units in a value range.

PEPL: Population density expressed in persons per housing unit. A different value may be used for each value range. This value is required for all categories except METRSEWR.

SMPR: Marginal price of water, as defined for ANPR, except for summer use only. This value may be different from ANPR where the rate structure causes the marginal price of water paid by the average consumer in a value group to differ seasonally. In this case, the marginal price paid during the summer, expressed in cents per 1,000 gallons is assigned to this variable. Otherwise, the value provided is identical to ANPR. This value may be different for each value range and is required for METRSEWR and METRSEPT only.

The data identification names for the residential summary card(s) are:

LOWV: Number of value ranges in low-value group. This group is defined as all value ranges having a median unit value below $25,500 (1980 dollars).

MEDV: Number of value ranges in medium-value group. This group is defined as all value ranges having a median unit value of at least $25,500, but less than $50,000 (1980 dollars).

HIGH: Number of value ranges in high-value group. This group is defined as all value ranges having a median value of at least $50,000 (1980 dollars).

Up to 25 value ranges may be defined within each residential subgroup. When the MAIN II System is used to forecast water requirements, each subgroup must end with a card containing a value for LOWV, MEDV, and HIGH, followed by the ENDD card. The value ranges themselves must be

placed so that all low-value group ranges appear first, followed by medium-value group ranges, and finally the high-value group ranges. The value ranges may not include values that cross the low, medium, and high summary ranges (0-$25,499; $25,500-$49,999; and $50,000-plus, respectively).

Figure 4 shows a sample of current-year residential data.

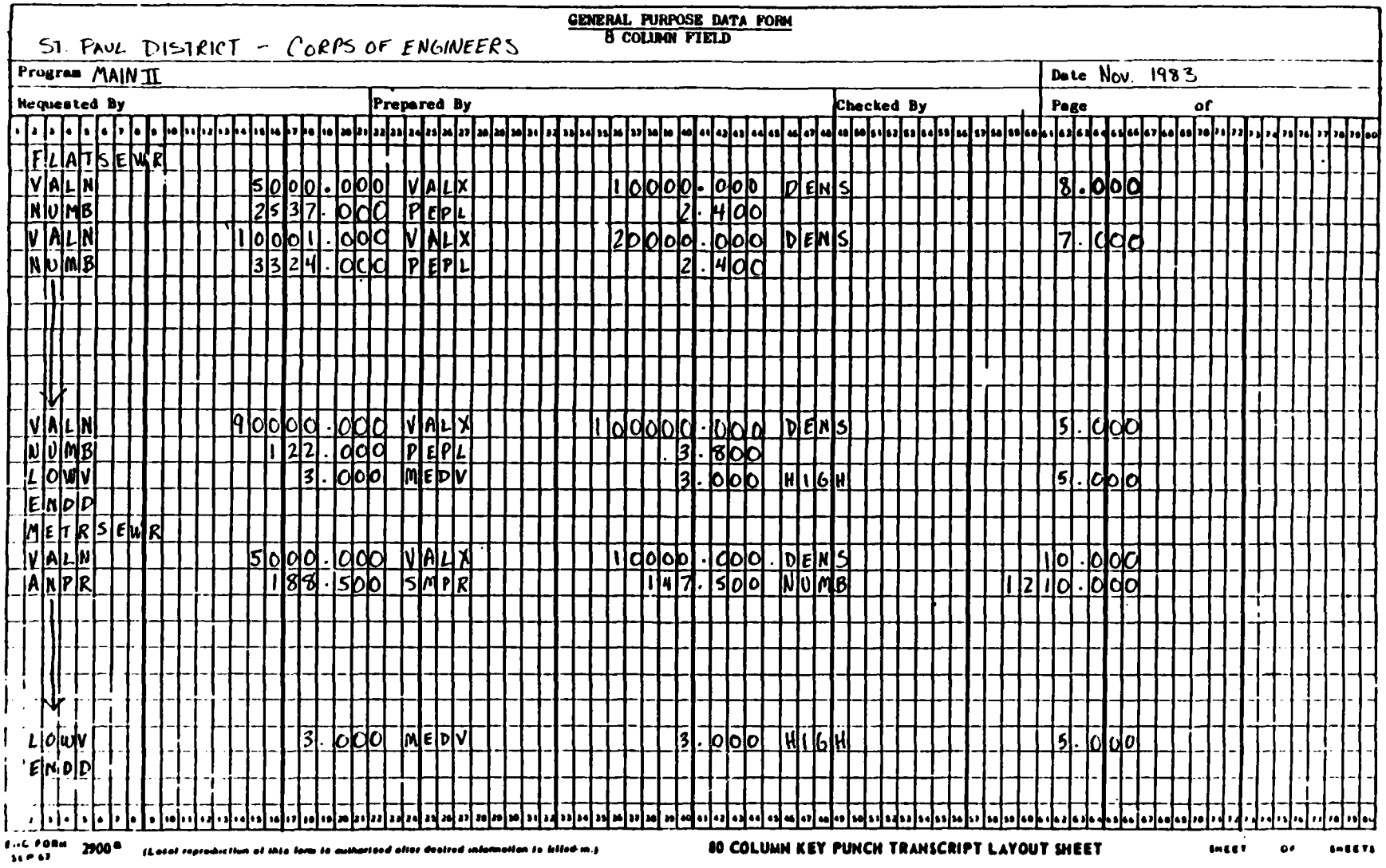


Figure 4. Current-Year Residential Sample

Commercial/Institutional Sector

Tne MAIN II System uses 28 commercial and institutional categories to estimate water requirements for this sector of a community. Where local water-use patterns suggest the need for other categories, they may be added by the user. This modification consists of placing the necessary labels, water-use parameter identifications, and usage coefficients in the Library of Water Usage Coefficients, as described in chapter III. Whenever estimates of commercial/institutional requirements are to be included in computations of current or forecasted water requirements, the following subgroup must be used:

COMMPARM

The cards following tne subgroup name card contain the data identification names for any of the 28 commercial/institutional categories listed in figure 5. Each data identification name is followed by the value of the water-use parameter for that category. These values are computed as of the current, or base, year. Data identification names for categories added by the user are C001, C002, C003, etc., up to a maximum of 22 additional categories (i.e., C022). The COMMPARM subgroup ends with the ENDD card.

Figure 6 is a sample of current-year commercial/institutional data.

Data Identification Name	Category Name	Parameter Units
BARB	Barber Shops	Barber Chairs
BEUT	Beauty Shops	Stations
DPOT	Bus, Rail Depots	Square Feet
CARW	Car Washes	Inside Square Feet
CHUR	Churches	Members
CLUB	Golf, Swim Clubs	Members
BOWL	Bowling Alleys	Alleys
COLG	College Residences	Students
HOSP	Hospitals	Beds
HOTL	Hotels	Square Feet
LNDM	Laundromats	Square Feet
LNDY	Laundries	Square Feet
MEDL	Medical Offices	Square Feet
MOTL	Motels	Square Feet
MOVI	Drive-In Movies	Car Stalls
NURS	Nursing Homes	Beds
OFFN	New Office Buildings	Square Feet
OFFO	Old Office Buildings	Square Feet
JAIL	Jail and Prison	Persons
EATN	Restaurants	Seats
EATO	Drive-In Restaurants	Car Stalls
NITE	Night Clubs	Persons Served
SALE	Retail Space	Sale Square Feet
SKLL	School, Elementary	Students
SKLY	School, High	Students
YMCA	YMCA, YWCA	Persons
GASS	Service Stations	Inside Square Feet
THTR	Theatres	Seats

Figure 5. Commercial and Institutional Categories: Data Identification Names, Category Names, and Parameter Units

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
COMMDARM
BARB                50.000 BEUT                165.000 EATN                5500.000
EATC               400.000 HOSP                663.000 NURS                487.000
MEDL          1038442.000 LNDY           2304242.000 CARW           1354787.000
YMCA            93499.000 C001             4500.000
ENDD
```

F...C FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 6. Current Year Commercial/Institutional Data Sample

Industrial Sector

When industrial water requirements are to be included in calculations of current or forecast municipal water use, the following subgroup must be provided:

INDPARAM

The subgroup name card is followed by cards containing data identification names and the values of the associated water-use parameters. These parameters are the total employment for each industrial category. The industrial categories are defined by the user, and can be either individual industries or industries grouped by S.I.C. codes. Figure 7 shows the industrial categories listed in the original version of MAIN II.

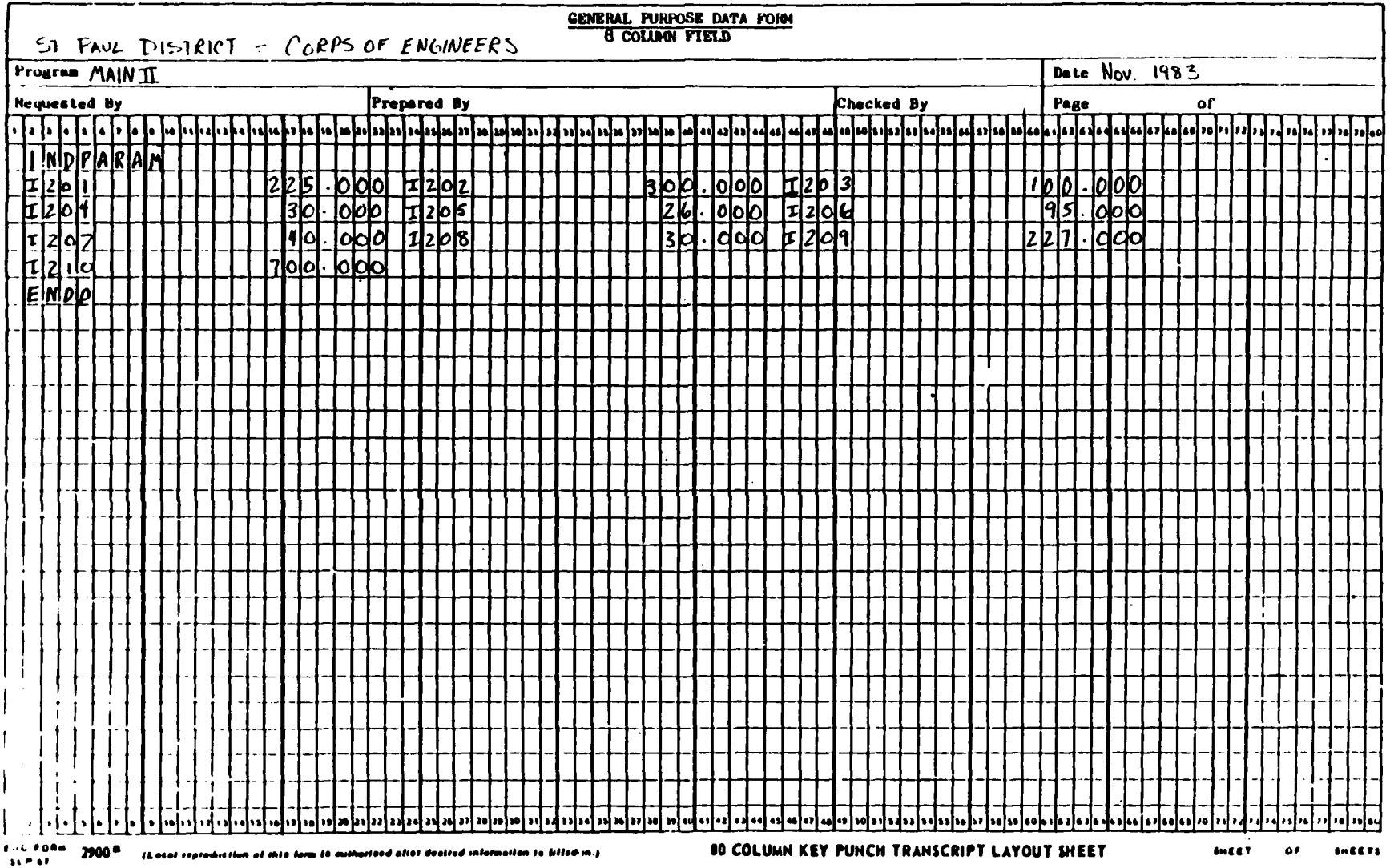
The proper data identification names are I201, I202, I203, etc. The employment provided for each category is the average employment for the current, or base, year. The necessary category label, data identification name, and water usage coefficient are contained in the Library of Water Usage Coefficients, as described in chapter III. These categories are limited to data identification names between I200 and I399, inclusive. The subgroup must end with the ENDD card. Figure 8 is an example of prepared data for this subgroup.

S.I.C. No.	Industrial Category	S.I.C. No.	Industrial Category
201	MEAT PRODUCTS	306	RUBBER PRODUCTS
202	DAIRIES	307	PLASTIC PRODUCTS
203	CANNED, FROZEN FOOD	311	LEATHER TANNING
204	GRAIN MILLS	321	FLAT GLASS
205	BAKERY PRODUCTS	322	PRESSED, BLOWN GLASS
206	SUGAR	323	PRODUCTS OF PURCHASED GLASS
207	CANDY	324	CEMENT, HYDRAULIC
208	BEVERAGES	325	STRUCTURAL CLAY
209	MISC. FOODS	326	POTTERY PRODUCTS
211	CIGARETTES	327	CEMENT, PLASTER
221	WEAVING, COTTON	328	CUT STONE PRODUCTS
222	WEAVING, SYNTHETICS	329	NON-METALLIC MINERALS
223	WEAVING, WOOL	331	STEEL ROLLING
225	KNITTING MILLS	332	IRON, STEEL FOUNDRIES
226	TEXTILE FINISHING	333	PRIME NON-FERROUS
227	FLOOR COVERING	334	SECONDARY NON-FERROUS
228	YARN, THREAD MILLS	335	NON-FERROUS ROLLING
229	MISC. TEXTILES	336	NON-FERROUS FOUNDRIES
230	WHL. APPAREL INDUSTRY	339	PRIME METAL INDUSTRIES
242	SAW-PLANING MILLS	341	METAL CANS
243	MILLWORK	342	CUTLERY, HARDWARE
244	WOOD CONTAINERS	343	PLUMBING, HEATING
249	MISC. WOOD	344	STRUCTURE, METAL
251	HOME FURNITURE	345	SCREW MACHINE
259	FURNITURE FIXTURES	346	METAL STAMPING
261	PULP MILLS	347	METAL SERVICE
262	PAPER MILLS	348	FABRICATED WIRE
263	PAPERBOARD MILLS	349	FABRICATED METAL
264	PAPER PRODUCTS	351	ENGINES, TURBINE
265	PAPERBOARD BOXES	352	FARM MACHINERY
266	BLDG. PAPER MILLS	353	CONSTRUCTION EQUIPMENT
270	WHL. PRINT INDUSTRY	354	METALWORK, MACHINERY
281	BASIC CHEMICALS	355	SPEC. INDUSTRY MACH.
282	FIBERS, PLASTIC	356	GENERAL IND. MACH.
283	DRUGS	357	OFFICE MACHINES
284	SOAP, TOILET GOODS	358	SERVICE IND. MACH.
285	PAINT, ALLIED PRODUCTS	359	MISC. MACHINES
286	GUM, WOOD CHEMICALS	361	ELECTRIC DIST. PRODUCTS
287	AGRICULTURE CHEM.	362	ELECTRIC INDUSTRIAL APPARATUS
289	MISC. CHEMICALS	363	HOME APPLIANCES
291	PETROLEUM REFINING	364	LIGHT-WIRING FIXTURES
295	PAVING, ROOFING	365	RADIO-TV RECEIVING
301	TIRES AND TUBES	366	COMMUNICATION EQUIPMENT
302	RUBBER FOOTWEAR	367	ELECTRONIC COMPONENTS
303	RECLAIMED RUBBER	369	ELECTRIC PRODUCTS

Figure 7. Industrial Categories (with S.I.C. Numbers) Listed in the Original MAIN II System**(Continued on Next Page)**

371	MOTOR VEHICLES	386	PHOTOGRAPHIC EQUIPMENT
372	AIRCRAFT AND PARTS	387	WATCHES, CLOCKS
373	SHIP AND BOARD BUILDING	391	JEWELRY, SILVER
374	RAILROAD EQUIPMENT	394	TOYS, SPORT GOODS
375	MOTORCYCLE, BIKE	396	COSTUME JEWELRY
381	SCIENTIFIC INSTRUMENTS	398	MISC. MANUFACTURING
382	MECHANICAL MEASURING	399	MISC. MANUFACTURING
384	MEDICAL INSTRUMENTS		

Figure 7. Industrial Categories (with S.I.C. Numbers) Listed in the Original MAIN II System (Concluded)


GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II

Date Nov. 1983

Requested By

Prepared By

Checked By

Page of

```
INDPARAM
I201                225.000 I202                300.000 I203                100.000
I204                 30.000 I205                 26.000 I206                 95.000
I207                 40.000 I208                 30.000 I209                227.000
I210                700.000
ENDP
```

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 8. Industrial Data Sample

Public/Unaccounted Sector

Four data subgroups are provided for specifying public and unaccounted water requirements:

PUBPARAM
PUBANAVE
PUBMAXDY
PUBPEKHR

Within each of these subgroups, the system provides three categories of water use. The system user may define up to 27 additional categories. The system-provided categories follow:

LOSS, FSER, AIRP

The definitions of the three system-provided categories are given below:

LOSS: Water use unaccounted for or lost in the system, including leaks and apparent losses through meter misregistration. The parameter for this category is population, and historical data may be either actual historical population or an equivalent population found by dividing actual losses by the water-use coefficient for the categor . The data value is expressed in number of persons.

FSER: Accountable use from free services, including street flushing, fire suppression, public buildings, parks, etc. The water-use parameter for this category is population, and historical data may be either actual historical population or any equivalent population found by dividing

actual free services by the water-use coefficient for the category. The data value is expressed in number of persons.

AIRP: Use of water by airports, to the extent that it is supplied by the municipal system. The water-use parameter is the number of airline passengers per day, and the data value is expressed in number of persons.

The water-use parameter for airports, AIRP, is the average number of passengers using the facility per day. The parameter for the other two data identification names, LOSS and FSER, is the total population of the study area. Additional categories that may be added by the user will have data identification names P001, P002, P003, etc., up to category P027. These categories will have water-use parameters specified by the user.

The PUBPARAM subgroup is used to provide the current, or base year, value of the water-use parameter for the AIRP category, as well as any user-added categories.

When the user prefers to specify the actual values of water use for certain public/unaccounted categories, he may do so by using the PUBANAVE, PUBMAXDY, and PUBPEKHR subgroups. These subgroups, when used, should all appear. The data identification names for the categories to be processed in this manner are followed by the user-provided estimate of water required for that category and subgroup, expressed in gallons per day. The PUBANAVE subgroup contains mean-annual average requirements. The PUBMAXDY subgroup contains maximum-day requirements, and the PUBPEKHR subgroup is used for peak-hour requirements. Use of these subgroups does

not preclude use of the PUBPARAM subgroup for other categories. If the same category is entered both ways, the values provided in PUBANAVE, PUBMAXDY, and PUBPEKHR will be used.

All subgroups must end with the ENDD card. Examples of prepared data for these subgroups are shown in figure 9.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
PUBPARAM
AIRP                    2500.000
ENDD
PUBANAVE
LOSS                8576884.000 FSER        5112250.000
ENDD
PUBMAXDY
LOSS                8576884.000 FSER        5112250.000
ENDD
PUBPEKHR
LOSS                8576884.000 FSER        5112250.000
ENDD
```

FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 9. Public/Unaccounted Data Sample

PROJECTION DATA

The MAIN II System forecasts municipal water requirements by projecting the values of the individual parameters used in the system. Forecasts can be made for up to 20 separate projection years. Each forecast is independent of the others. Forecasts for the same calendar year, based on different sets of projection data, can be made for comparison.

Projections of individual water-use parameters can be carried out in any of three ways:

- o Projections of per capita growth (default projection if no other data is provided).
- o Projection by extrapolation of local historical trends.
- o Projections made external to the MAIN II System.

Projected changes in the water-use per unit parameters may also be made in the forecasts of commercial and industrial use.

In summary, for each projection year and for each parameter, the projection method may be selected independently of other parameters and other years. For example, the first projection method may be employed for a given commercial parameter in one projection year, the second in another, and the third in still another, even though other options were being selected for all other commercial parameters. The projection method applied to each parameter is flagged on the output.

The MAIN II System may be used to simultaneously project water requirements for up to 24 separate years in addition to the base year. The 24 years may include the same year repeated several times with

different projection options or alternative data points. Each iteration of a year with different options or data points counts as a separate year. The output reports produced by the MAIN II System include a set of detailed reports for each year named, including the base year. These reports are described in chapter IV. They include a detailed breakdown of residential, commercial/institutional, industrial, and public/unaccounted water use as well as a summary for each year. In addition, an overall summary is provided, listing annual average, maximum day, and peak-hour water requirement estimates for each year. Where no input is provided for a specific segment of water use, no report is printed.

Key Projection Data

Each forecast year is specified by the appearance of the following subgroup name card:

NEWYEAR

This group contains the required key projection categories listed below:

YEAR, POPU

The definitions of these projection categories follow:

YEAR: The calendar year for which the forecast is desired. This may be any year subsequent to the base year names in the CITYDATA subgroup.

POPU: The population projection for the study area in the forecast year (YEAR). This projection is required and must be prepared externally. It is expressed in the number of persons residing within the study area.

Figure 10 is a sample of the key projection data.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
NEWYEAR
YEAR          1990.000
TOPU      6393 5.000
END
```

ENG FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 10. Key Projection Data Sample

Projection by Per Capita Growth (Default Projection)

The projection by per capita growth method assumes that aggregate water use per person does not change over time. With this methodology, growth in the parameter directly follows growth in population, so the choice of population projection (which must be supplied by the planner) is crucial. This method is generally considered to be a weak predictor of future use because many other growth factors besides population affect water use. This method requires little projection data, however, and can be useful for studies that do not require a high level of detail.

Per capita growth will be applied to all parameters that do not have historical or external projection data supplied. For certain parameters, growth on a per capita basis may be a reasonable projection assumption. More careful study of the growth of the individual parameters (especially for major users in the study area) is strongly recommended, however, because a per capita assumption is generally weak.

Projection by Extrapolation of Local Historical Trends

This projection method assumes that growth in the future will follow the same trend as growth in the past. This assumption, of course, will not always be a good one, especially in parameters that have recently shown rapid growth and that are likely to taper off in the future. This is an intermediate-level growth method that requires careful selection of data points indicative of the apparent long-run trend. It also could require extensive data collection from the various sectors being studied.

For projections using historical data, the data points collected should cover at least 10 years for each variable. In certain cases, it may be desirable to reduce this period to exclude unrepresentative or unreliable data. At least two but not more than five data points may be provided

for each factor. Where the historical change of a factor is not linear, sufficient data points should be provided to adequately describe the actual change.

Residential Sector - Projection by extrapolation of historical trends may be selected for residential parameters by providing the following data subgroup:

HNUMHOMS

This subgroup uses the following data identification names:

YEAR, MWLO, MWMD, MWHI, FWLO, FWMD, FWHI, MPLO, MPMD, MPHI, FPLO, FPMD, FPHI

The definitions for these data identification names follow:

YEAR: The year to which the data points immediately following apply. In every case, the first data identification name in the subgroup must be YEAR, and all data following it and prior to the appearance of another YEAR will be interpreted as associated with the first YEAR. The data value is expressed as a calendar year and may be any year, including the base year.

MWLO, FWLO, MPLO, FPLO: The total number of housing units in the low-value group that are in the metered-sewered, flat rate-sewered, metered-septic tank, or flat rate-septic tank categories, respectively.

MWMD,
FWMD,
MPMD,
FPMD:

The total number of housing units in the medium-value group, categories as defined above.

MWHI,
FWHI,
MPHI,
FPHI:

The total number of housing units in the high-value group, categories as defined above.

The HNUMHOMS subgroup must end with an ENDD card.

The low-, medium-, and high-value ranges are the same as those defined on page 19.

Figure 11 is a sample of data for the HNUMHOMS subgroup.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date NOV. 1983

Requested By | Prepared By | Checked By | Page of

```
HNUMHOMES
YEAR  1962.000  MWLO  3874.000  MWMD  6100.000
MWHI   985.000
YEAR  1972.000  MWLO  4229.000  MWMD  6900.000
MWHI  1725.000
YEAR  1982.000  MWLO  4974.000  MWMD  7691.000
MWHI  3007.000
ENDD
```

E.C. FORM 2900 (Latest reproduction of this form is authorized after desired information is filled-in.) 80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET SHEET OF SHEETS

Figure 11. Projection Data Sample, HNUMHOMS Subgroup

Commercial/Institutional Sector - Any of the commercial/institutional category parameters may be projected by extrapolation of local historical trends through the use of the following data subgroup:

HCOMPARM

The data identification names for this subgroup are:

YEAR, HOTL, MOTL, etc., C001, C002, C003, etc.

The definitions of these data identification names follow:

YEAR: The year to which all data points immediately following apply. In every case, the first data identification name in the subgroup must be YEAR, and all data following it and prior to the appearance of another YEAR will be interpreted as associated with the first YEAR. The data value is expressed as calendar year, which may be any year, including the base year.

HOTL, MOTL, etc.: The data identification names of the 28 built-in commercial/institutional parameters, as listed in figure 5. The data value immediately following each is the value of the parameter for the YEAR specified. The units are also listed in chapter III.

C001, C002, etc.: The data identification names of up to 22 additional commercial/institutional parameters that may be added by the user. When one or more of these have been added, the historical data may be placed after the proper data identification name, in the units previously defined by the user.

The HCOMPARM subgroup must end with an ENDD card.

Figure 12 is a sample of data for the HCOMPARM subgroup.

GENERAL PURPOSE DATA FORM
3 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date NOV. 1983

Requested By | Prepared By | Checked By | Page of

```
HCOMPARM
YEAR          1972.000  HOTL          76014.000  BEUT  102.000
HOSP           330.000  LNDM          12603.000
YEAR          1977.000  HOTL         101348.000  BEUT  115.000
HOSP           663.000  LNDM          14387.000
YEAR          1982.000  HOTL         106015.000  BEUT  165.000
HOSP           663.000  LNDM          17813.000
ENDD
```

EIC FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 12. Projection Data Sample, HCOMPARM Subgroup

Industrial Sector - The industrial parameters may be projected by extrapolation of historical records of employment by providing the proper data in the following subgroup:

HINDPARM

The data identification names for this subgroup follow:

YEAR, I201, I202, I203, etc.

The definitions of the data identification names are given below:

YEAR: The year to which all data points immediately following apply. In every case, the first data identification name in the subgroup must be YEAR, and all data following it and prior to the appearance of another YEAR will be interpreted as associated with the first YEAR. The data value is expressed as a calendar year and may be any year, including the base year.

I201, I202, etc.: The data identification names of the industrial categories, as listed in figure 9. The data value immediately following each is the employment in the industry category for the year names in YEAR. The data values are expressed in numbers of persons employed within the study area.

The HINDPARM subgroup must end with an ENDD card.

Figure 13 is a sample of data for the HINDPARM subgroup.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
HINDPARM
YEAR                1972.000 I203                  63.000 I210 0                983.000
I217                   75.000
YEAR                1977.000 I203                  87.000 I210 0                645.000
I217                   77.000
YEAR                1982.000 I203                 100.000 I210 0                700.000
I217                   90.000
END
```

EJC FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 13. Projection Data Sample, HINDPARM Subgroup

Public/Unaccounted Sector - Public/unaccounted parameters may be projected by extrapolation of local historical data when the proper data is placed in the following data subgroup:

HPUBPARM

The data identification names for this subgroup follow:

YEAR, LOSS, FSER, AIRP, P001, P002, etc.

The definitions of these data identification names are given below:

LOSS, These definitions are the same as those given on page 29
FSER, and 30 in the Public/Unaccounted Sector subsection under
AIRP: Current Year Data.

The HPUBPARM subgroup must end with an ENDD card.

Note: Extrapolation of historical trands cannot be applied to parameters in the PUBANAVE, PUBMAXDY, and PUBPEKHR subgroups. External projections, described in the next section, can be applied to these parameters, however.

Figure 14 shows a sample of HPUBPARM data.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
HPUBPARAM
YEAR          1972.000 LOSS        750000.000 FSER          470000.000
YEAR          1982.000 LOSS        950000.000 FSER          495000.000
YEAR          1982.000 LOSS        857684.000 FSER          511225.000
END
```

F...C FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.) 80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET SHEET OF SHEETS

Figure 14. Projection Data Sample, HPUBPARM Subgroup

Direct External Projections

This projection method allows planners to use any method or information at their disposal to fix parameters at given points in the future. If, for example, an industry knows it will be employing 60 workers at a point in the future, planners can input this information directly. Similarly, if an entity (or category, such as libraries) is not expected to grow in the study period, planners can specify this.

Categories expected to arise in the future can also be projected externally, by setting the parameter for that category at zero until the year it is projected to begin water use.

Changes in the water-use function can also be projected by modifying the use/unit parameters with use-modification factors described in this section.

Direct external projections may be made in each of the four use sectors.

Residential Sector - Direct projections of residential data are made using the following subgroup:

NUMHOMES

The data identification names are:

MWLO, MWMD, MWHI, MPLO, MPMD, MPHI, FWLO, FWMD, FWHI, FPLO, FPMD, FPHI

Definitions of these data identification names are the same as those listed in the Projection by Extrapolation of Local Historical Trends section.

Use-modification factors for the residential sector are not currently available.

Figure 15 is a sample of direct external projections in the residential sector.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II

Date Nov. 1983

Requested By

Prepared By

Checked By

Page of

```
NUMHOMES
MWLO                4893.000 MWMD                9788.000 MWHI                4686.000
END
```

FORM 2900 (Least reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 15. Projection Data Sample, NUHOMES Subgroup

Commercial/Institutional Sector - Any of the Commercial/Institutional category parameters may be projected directly with externally-supplied data through use of the following subgroup:

COMFPARM

The data identification names for this subgroup are given below:

YEAR, HOTL, MOTL, etc., C001, C002, etc.

Definitions of these data identification names are the same as those listed in the Projection by Extrapolation of Local Historical Trends section.

Projected changes in the water-use function for any commercial/institutional entity can be made using the following subgroup:

COMFACTR*

To project changes, multiplicative and/or additive factors can be used on the water-use function, as shown in the following example.

* When using the COMFACTR subgroup for projected conservational studies, each year must be specified for the commercial factors that one is working with. The new commercial factors will apply only to the specified years and only to projections that are directly inputed (i.e., external projections). Also, a commercial factor must be specified for each individual commercial parameter.

Data identification names are:

YEAR, HOTL, MOTL, etc., C001, C002, etc.

Definitions of these data identifications names are the same as those listed in the Projection by Extrapolation of Local Historical Trends section.

Sample calculation:

Example: MOTELS, 20 percent reduction because of technological changes in showerheads and faucets

Use = MOTL (sq ft, etc.) x use/unit (gals/sq ft, etc.) x multiplicative factor + additive factor

$$\text{Use} = 128{,}000 \text{ sq. ft.} \times \frac{.326^{*}}{\text{gals/sq ft}} \times (.80) + 0$$

* Value of parameter built into Library of Water Usage Coefficients. See figure 24.

Figure 16 provides a sample of externally-provided commercial/institutional sector projection data and use-modification factor data.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
COMFPARM
HOSP                663.000 MEDL          2076891.000
ENDD

COMFACTR
MOTL                0.8                   0
ENDD
```

ENG FORM 2900-R (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET SHEET OF SHEETS

Figure 16. Projection Data Sample, COMFPARM and COMFACTR Subgroups

Industrial Sector - Any of the industrial sector category parameters may be projected directly with externally-supplied data through use of the following subgroup:

INDPROJT

The data identification names for this subgroup are given below:

I201, I202, I203, etc.

Definitions of these data identification names are the same as those listed in the Projection by Extrapolation of Local Historical Trends section.

The water-use function for the industrial sector is as follows:

Daily Use = (Employees) x (use per day/employee) x (productivity) x (efficiency)

In the base year, the productivity and efficiency factors used in the preceding equation both have values of 1 (one). Changes in these factors can be projected through use of the following subgroups:

INDEFF	(efficiency)
INDPROD	(productivity)

The data identification names for these subgroups are:

I201, I202, I203, etc.

Definitions of these data identification names are the same as those listed in the Projection by Extrapolation of Local Historical Trends section.

NOTE: Two modifications for use are available so that one can be used for projections, and one can be used for conservation scenarios (see page 63) if desired.

Figure 17 provides a sample of externally-provided industrial sector projection data and use-modification factor data.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
INDPROJT
I201                170.000 I202                267.000 I205                72.000
I207                 40.000 I210                700.000 I214              1625.000
I219                240.000 I222                 50.000 I223                60.000
I224                400.000
END
```

FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 17. Projection Data Sample, INDPROJT Subgroup

Public/Unaccounted Sector - External projections in the public/unaccounted sector can be made through the use of the following data subgroups:

PUBPARAM
PUBANAVE
PUBMAXDY
PUBPEKHR

The data subgroup PUBPARAM permits the use of external projections of water-use parameters, while the subgroups PUBANAVE, PUBMAXDY, and PUBPEKHR accommodate external projection of water requirements. These last three subgroups should be used together. The data identification names are the same for all four data subgroups:

LOSS, FSER, AIRP, P001, P002, etc.

Definitions of these data identification names are the same as those listed in the Projection by Extrapolation of Local Historic Trends section.

Figures 18 through 21 provide samples of externally-provided public/unaccounted sector projection data.

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
PUBPARAM
AIRP                    3150.000
END
```

FMC FORM 2900 (Local reproduction of this form is authorized after desired information is filled-in)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 18. Projection Data Sample, PUBPARAM Subgroup

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

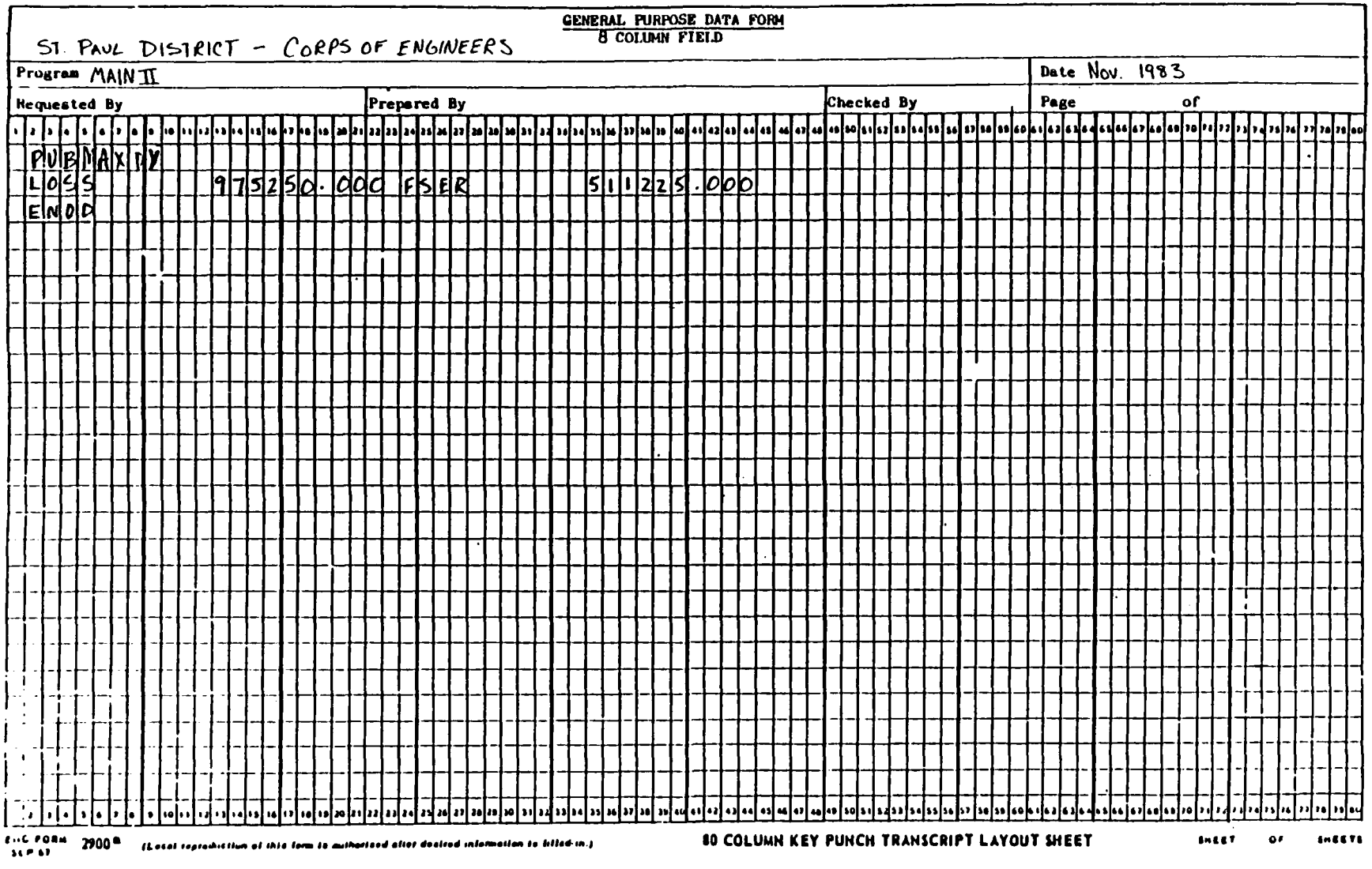
Requested By | Prepared By | Checked By | Page of

```
PUBANAVE
LOSS          975250.000 FSER          511225.000
ENDD
```

ENG FORM 2900 SEP 67 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET SHEET OF SHEETS

Figure 19. Projection Data Sample, PUBANAVE Subgroup


GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II

Date Nov. 1983

Requested By

Prepared By

Checked By

Page of

PUBMAXDY
LOSS 975250.000 FSER 511225.000
END

EMC FORM 2900 (Local reproduction of this form is authorized after desired information is filled-in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 20. Projection Data Sample, PUBMAXDY Subgroup

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST. PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
PUBPEKHR
LOSS                 975250.000 FSER          511225.000
ENDD
```

FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 21. Projection Data Sample, PUBPEKHR Subgroup

End of Projection Data

The end of the projection data associated with each forecast year must be signaled to the system by an ENDYEAR card. This card is placed after the ENDD card of the last data subgroup following the NEWYEAR subgroup or after the ENDD card of the NEWYEAR subgroup if no optional projection methods are being used. The format of the card is as follows:

ENDYEAR

An ENDYEAR card must follow each complete set of projection data for each forecast year.

End of Input Data

After all data have been prepared, including municipal data, current year data, and projection data, as required, the end of the data stream must be signaled to the system by an ENDINPUT card. When the computer program encounters this card, it terminates reading data and begins to read the contents of the Library of Water Usage Coefficients. The format of this card is as follows:

ENDINPUT

When the last data subgroup is part of the projection data, it terminates normally in an ENDD card, which is followed by a ENDYEAR card signaling the end of that forecast year's projection data, and finally, by the ENDINPUT card, which is, in every case, the last card encountered in the data record for a given run. When multiple runs are made, e.g., successive runs with altered municipal data, or runs on separate study areas, and when the library is stored on media other than punched cards, the ENDINPUT card may be followed immediately by the OPTIONS subgroup of

the second run. Any number of runs can be stacked in this manner, with each individual run ending with an ENDINPUT card. A complete set of MAIN II reports will be generated for each run.

Conservation Options

The MAIN II model can be used as a tool to assist water planners in their creation of water conservation scenarios. The current-year use and projection-year use estimates created by or for the planner can be used as a base (initial condition) simulating the effect of water conservation scenarios. Since the MAIN II use estimates are disaggregated, simulated application of conservation measures can be applied at the level of individual use categories. MAIN II does not have built-in reduction parameters; these must be obtained externally (see appendix of sources). Once these parameters are obtained, however, they can be used to develop use-reduction parameters that can be applied in MAIN II through the use-modification factors (decribed on pages 51-56).

These factors are applied in exactly the same way as they would be for projecting changes in the water-use function. The only difference is that they represent hypothetical conservation scenarios rather than changes anticipated in the "no-action" or "initial" condition projection.

CHAPTER III. LIBRARY OF WATER USAGE COEFFICIENTS

GENERAL DESCRIPTION OF LIBRARY

The Library of Water Usage Coefficients is one of the products of the MAIN II System. It consists of all the invariant data needed by the system, such as residential equation constants; climatic data for the entire United States, category labels, and usage coefficients for the commercial, industrial, and public/unaccounted submodels. It may be easily modified from a general-purpose nationwide collection of data into a very specialized local library. An abridged listing of the contents of the library (including climatic data for the Upper Midwest only) is in appendix B. The physical characteristics of the library are discussed below. A section describing how to update and modify the library follows that discussion.

Data Card Formats

The library data have three different card formats. The subgroup name card and the general data cards are the same as discussed previously in Chapter II, but the climatic data card has a different format, as indicated in figure 22. Since the four data items listed on the card, plus the coordinates of the grid point, are needed to describe the climatic conditions at a grid point, this card was specifically designed for these data.

Card Column No.	Item
1	blank
2-5	data identification name
6	blank
7-18	data field
19	blank
20-23	data identification name
24	blank
25-36	data field
37	blank
38-41	data identification name
42	blank
43-54	data field
55	blank
56-59	data identification name
60	blank
61-72	data field
73-80	any user comments

Figure 22. Climatic Data Card Format

USE OF THE LIBRARY

The Library of Water Usage Coefficients provides data inputs to the MAIN II System. These data include residential equation constants, coefficients of use for many different types of establishments and industries, and climatic information. This library allows the user to make water-use computations without having to research the data values again. The user is able to make changes in use coefficients where local data differ from the library data.

The residential and industrial data represent the results of evaluation of national figures. The commercial data are largely oriented towards study of establishments in Baltimore, Maryland, and need to be refined and compared with data values from other cities as they become available. An incomplete list of other data sources is in appendix D.

LIBRARY DATA

This section of the report explains how the library data were prepared. The data for each of the submodels, except the residential submodel, are composed of several data subgroups, such as category labels and usage coefficients. The details of the data preparation are discussed below.

Residential Data

The system equations for the residential submodel are shown in appendix C, equation numbers 1 through 16, inclusive. The numeric constants in the equations were put in the library to facilitate future refinements and changes. The subgroup name card for the residential equation constants is given below:

CONSTANT

The data identification names consist of the letter E followed by three numbers, the first two referring to the equation number, and the last indicating the number of the constant in the equation (first, second, third, etc.). Figure 23 tabulates the existing data identification names and constants.

Data Identification Name	*Equation Number	Constant Number	Constant Value
E011	1	1	206.000
E012	1	2	3.470
E013	1	3	-1.300
E021	2	1	28.900
E022	2	2	4.390
E023	2	3	33.600
E031	3	1	30.200
E032	3	2	39.500
E041	4	1	30.200
E042	4	2	39.500
E051	5	1	0.480
E052	5	2	1130.000
E053	5	3	-0.703
E054	5	4	0.429
E061	6	1	0.390
E062	6	2	0.164
E063	6	3	-0.793
E064	6	4	2.930
E065	6	5	-1.570
E066	6	6	1.450
E071	7	1	0.410
E072	7	2	100.000
E073	7	3	0.783
E081	8	1	0.340
E082	8	2	0.164
E083	8	3	-0.793
E084	8	4	2.930
E085	8	5	-1.570
E086	8	6	1.450
E091	9	1	0.410
E092	9	2	100.000
E093	9	3	-0.783
E094	9	4	2.930
E095	9	5	-1.570
E096	9	6	1.450
E101	10	1	0.830
E102	10	2	-1.260
E111	11	1	3400.000

* See appendix C for corresponding equations.

Figure 23. Residential Equation Constants for the Library of Water Usage Coefficients
(Continued on Next Page)

Data Identification Name	*Equation Number	Constant Number	Constant Value
E112	11	2	2.060
E113	11	3	0.413
E121	12	1	0.0106
E122	12	2	0.118
E123	12	3	-10.400
E124	12	4	-1.250
E125	12	5	0.931
E131	13	1	2750.000
E132	13	2	0.943
E133	13	3	0.523
E141	14	1	0.0106
E142	14	2	0.118
E143	14	3	-10.400
E144	14	4	-1.250
E145	14	5	0.931
E151	15	1	2750.000
E152	15	2	0.943
E153	15	3	0.523
E154	15	4	1.250
E155	15	5	0.931
E161	16	1	334.000
E162	16	2	2.017

* See appendix C for corresponding equations.

Figure 23. Residential Equation Constants for the Library of Water Usage Coefficients (Concluded)

Commercial Data

Five data subgroups are in the library to describe the commercial submodel. The five subgroup name cards follow:

COMLABEL
COMMAVEG
COMMAXDY
COMMPEAK
COMMUNIT

These subgroup names have the following respective meanings: COMLABEL - commercial category labels, COMMAVEG - mean-annual usage coefficients, COMMAXDY - maximum-day usage coefficients, COMMPEAK - peak-hour usage coefficients, and COMMUNIT - parameter unit labels. There are 28 general-purpose commercial and institutional categories built into the library. Figure 24 lists these categories with data identification names, category names, parameter units, and six sets of usage coefficients. Three of the sets of usage coefficients are the expected values incorporated in the library. The other three shown are design values. They represent the upper 95-percent confidence limit of the data measured in the original study of commercial/institutional water use. Since the variance in water use among individual establishments in the same category can be considerable, caution should be exercised in applying the expected values of the coefficients to categories containing only one or several establishments. There may be instances where the user may wish to replace coefficients in the library with local values when the number of establishments is very small. Figure 24 contains listings of the commercial category labels, parameter unit labels, and usage coefficients.

Data Identification Name	Commercial Category	Parameter	Coefficients (gallons/day/unit of parameter)					
			Design Usage Coefficients			Library Data Expected Usage Coefficients		
			Mean Annual	Max. Day	Peak Hour	Mean Annual	Max. Day	Peak Hour
BARB	Barber Shops	Barber Chairs	97.5	123.0	432.0	54.6	80.3	389.0
BEUT	Beauty Shops	Stations	532.0	591.0	1330.0	269.0	328.0	1070.0
DPOT	Bus-Rail Depot	Sq. Ft.	5.0	9.8	37.6	3.33	6.5	25.0
CARW	Car Washes	Inside Sq. Ft.	4.78	10.3	31.5	4.78	10.3	31.5
CHUR	Churches	Members	0.138	0.862	4.7	0.138	0.862	4.7
CLUB	Golf-Swim Clubs	Members	33.3	33.3	33.3	22.2	22.2	22.2
BOWL	Bowling Alleys	Alleys	200.0	200.0	200.0	133.0	133.0	133.0
COLG	College Resid.	Students	179.0	187.0	323.0	106.0	114.0	250.0
HOSP	Hospitals	Beds	559.0	764.0	1120.0	346.0	551.0	912.0
HOTL	Hotels	Sq. Ft.	0.256	0.294	0.433	0.256	0.294	0.433
LNDM	Laundromats	Sq. Ft.	6.39	7.12	19.6	2.17	2.90	15.4
LNDY	Laundry	Sq. Ft.	0.639	0.712	1.96	0.253	0.461	1.57
MEDL	Medical Offices	Sq. Ft.	0.618	1.66	4.97	0.618	1.66	4.97
MOTL	Motels	Sq. Ft.	0.326	0.563	1.65	0.224	0.461	1.55
MOVI	Drive-In Movies	Car Stalls	8.0	8.0	8.0	5.33	5.33	5.33
NURS	Nursing Homes	Beds	209.0	222.0	500.0	133.0	146.0	424.0
OFFN	New Office Bldg.	Sq. Ft.	0.164	0.224	0.592	0.193	0.173	0.521
OFFO	Old Office Bldg.	Sq. Ft.	0.273	0.345	0.928	0.142	0.264	0.797
JAIL	Jail and Prison	Persons	200.0	200.0	200.0	133.0	133.0	133.0
EATN	Restaurants	Seats	55.2	114.0	198.0	24.2	83.4	167.0
EATO	Drive-In Rest.	Car Stalls	109.0	216.0	820.0	109.0	144.0	547.0
NITE	Night Clubs	Persons Served	2.0	2.0	2.0	1.33	1.33	1.33
SALE	Retail Space	Sale Sq. Ft.	0.16	0.232	0.412	0.106	0.154	0.271
SKLL	School, Elem.	Students	7.38	9.96	45.9	3.83	6.39	37.4
SKLH	School, High	Students	14.81	21.46	122.57	8.02	17.7	79.9
YMCA	YMCA - YWCA	Persons	50.0	50.0	50.0	33.3	33.3	33.3
GASS	Service Station	Inside Sq. Ft.	0.485	0.824	5.12	0.251	0.500	4.89
THTR	Theaters	Seats	5.0	5.0	5.0	3.33	3.33	3.33

Figure 24. Commercial Categories and Usage Coefficient Values for the Library of Water Usage Coefficients

Industrial Data

The library contains four data subgroups to describe the industrial submodel using the following subgroup name cards to control and input:

INDANAVE
INDLABLE
INDMXDAY
INDPEKHR

These subgroup names have the following meanings: INDANAVE - industrial mean-annual usage coefficients, INDLABLE - industrial category labels, INDMXDAY - industrial maximum-day usage coefficients, and INDPEKHR - industrial peak-hour usage coefficients. Data identification names for the industrial categories are shown as the letter I followed by the three-digit S.I.C. code. A complete list of those industrial categories in the library with usage coefficients is in figure 25.

S.I.C. Number	Industrial Category	Mean Annual Usage Coefficient* (gal/day/employee)
201	MEAT PRODUCTS	903.690
202	DAIRIES	791.350
203	CANNED, FROZEN FOODS	784.739
204	GRAIN MILLS	488.249
205	BAKERY PRODUCTS	220.608
206	SUGAR	1433.611
207	CANDY	244.306
208	BEVERAGES	1144.868
209	MISCELLANEOUS FOODS	1077.360
211	CIGARETTES	193.613
221	WEAVING, COTTON	171.434
222	WEAVING, SYNTHETICS	344.259
223	WEAVING, WOOL	464.439
225	KNITTING MILLS	273.439
226	TEXTILE FINISHING	810.741
227	FLOOR COVERING	297.392
228	YARN, THREAD MILLS	63.558
229	MISCELLANEOUS TEXTILES	346.976
230	WHOLE APPAREL INDUSTRY	20.000
242	SAW-PLANING MILL	223.822
243	MILLWORK	316.420
244	WOOD CONTAINERS	238.000
249	MISCELLANEOUS WOOD	144.745
251	HOME FURNITURE	122.178
259	FURNITURE FIXTURE	122.178
261	PULP MILLS	13,494.110
262	PAPER MILLS	2433.856
263	PAPERBOARD MILLS	2464.478
264	PAPER PRODUCTS	435.790
265	PAPERBOARD BOXES	154.804
266	BUILDING PAPER MILLS	583.355
270	WHOLE PRINT INDUSTRY	15.000
281	BASIC CHEMICALS	2744.401
282	FIBERS, PLASTICS	864.892
283	DRUGS	457.356
284	SOAP, TOILET GOODS	672.043
285	PAINT, ALLIED PRODUCTS	845.725
286	GUM - WOOD CHEMICALS	332.895
287	AGRICULTURE CHEMICALS	449.836
289	MISCELLANEOUS CHEMICALS	984.415
291	PETROLEUM REFINING	3141.100
295	PAVING, ROOFING	829.592
301	TIRES, TUBES	375.211

Figure 25. Industrial Categories and Usage Coefficient Values
(Continued on Next Page)

S.I.C. Number	Industrial Category	Mean Annual Usage Coefficient* (gal/day/employee)
302	RUBBER FOOTWEAR	82.592
303	RECLAIMED RUBBER	1031.523
306	RUBBER PRODUCTS	371.956
307	PLASTIC PRODUCTS	527.784
311	LEATHER TANNING	899.500
321	FLAT GLASS	590.140
322	PRESSED, BLOWN GLASSWARE	340.753
323	PRODUCTS OF PURCHASED GLASS	872.246
324	CEMENT, HYDRAULIC	279.469
325	STRUCTURAL CLAY	698.197
326	POTTERY PRODUCTS	326.975
327	CEMENT, PLASTER	353.787
328	CUT STONE PRODUCTS	534.789
329	NON-METALLIC MINERAL	439.561
331	STEEL ROLLING	494.356
332	IRON, STEEL FOUNDRIES	411.052
333	PRIME NON-FERROUS	716.626
334	SECONDARY NON-FERROUS	1016.596
335	NON-FERROUS ROLLING	675.475
336	NON-FERROUS FOUNDRIES	969.586
339	PRIME METAL INDUSTRIES	498.331
341	METAL CANS	162.547
342	CUTLERY, HARDWARE	459.300
343	PLUMBING, HEATING	411.576
344	STRUCTURE, METAL	319.875
345	SCREW MACHINE	433.193
346	METAL STAMPING	463.209
347	METAL SERVICE	1806.611
348	FABRICATED WIRE	343.367
349	FABRICATED METAL	271.186
351	ENGINES, TURBINES	197.413
352	FARM MACHINERY	320.704
353	CONSTRUCTION EQUIPMENT	218.365
354	METALWORK, MACHINERY	196.255
355	SPECIAL INDUSTRY MACHINERY	290.494
356	GENERAL INDUSTRIAL MACHINERY	246.689
357	OFFICE MACHINES	138.025
358	SERVICE INDUSTRIAL MACHINE	334.203
359	MISCELLANEOUS MACHINES	238.839
361	ELECTRIC DISTRIBUTION PRODUCTS	272.001
362	ELECTRIC INDUSTRIAL APPARATUS	336.016
363	HOME APPLIANCES	411.914
364	LIGHT-WIRING FIXTURES	369.592

Figure 25. Industrial Categories and Usage Cofficient Values
(Continued on Next Page)

S.I.C. Number	Industrial Category	Mean Annual Usage Coefficient* (gal/day/employee)
365	RADIO-TV RECEIVING	235.763
366	COMMUNICATION EQUIPMENT	86.270
367	ELECTRONIC COMPONENTS	203.289
369	ELECTRIC PRODUCTS	393.272
371	MOTOR VEHICLES	318.233
372	AIRCRAFT AND PARTS	154.769
373	SHIP AND BOAT BUILDING	166.074
374	RAILROAD EQUIPMENT	238.798
375	MOTORCYCLE, BIKE	414.859
381	SCIENTIFIC INSTRUMENTS	181.007
382	MECHANICAL MEASURE	237.021
384	MEDICAL INSTRUMENTS	506.325
386	PHOTOGRAPHIC EQUIPMENT	120.253
387	WATCHES, CLOCKS	164.815
391	JEWELRY, SILVER	306.491
394	TOYS, SPORT GOODS	213.907
396	COSTUME JEWELRY	423.124
398	MISCELLANEOUS MANUFACTURING	258.270
399	MISCELLANEOUS MANUFACTURING	258.270

* Maximum-day and peak-hour usage coefficients have not been determined at this time. Therefore, the library contains identical tables of the values tabulated here for the mean-annual usage coefficients. These data values can be supplied by the user if sufficient data are available.

Figure 25. Industrial Categories and Usage Coefficient Values (Concluded)

Public/Unaccounted Data

Public/unaccounted data in the library comprise four data subgroups. Input of these data is controlled by the following subgroup name cards:

PUBCOFAA
PUBCOFMD
PUBCOFPH
PUBLABEL

These subgroup names have the following meanings: PUBCOFAA - mean-annual usage coefficients, PUBCOFMD - maximum-day usage coefficients, PUBCOFPH - peak-hour usage coefficients, and PUBLABEL - category labels. Only three data identification names of categories are built into the public/unaccounted submodel:

AIRP, FSER, LOSS

The definitions of these names follow:

AIRP: Airport category

FSER: Free service category, which could include such detail items as firefighting, street cleaning, zoos, parks, fountains, museums, and public offices and buildings.

LOSS: Unaccounted water use due to distribution losses, etc.

Figure 26 shows the usa' . coefficients for each of the public/unaccounted categories.

Data Identification Name	Category	Mean Annual Usage Coefficient*
LOSS	Distribution Losses	14.9
FSER	Free Service	5.2
AIRP	Airports	5.0

* Values for the maximum-day and peak-hour are the same as the values for mean-annual usage coefficients.

Figure 26. Public/Unaccounted Categories and Usage Coefficient Values for the Library of Water Usage Coefficients

Climatic Data

The residential sprinkling equations require climatic data values to compute water use. Since the MAIN II System is intended for use by Anycity, U.S.A., the Library of Water Usage Coefficients was designed to contain the required climatic data for the entire United States. Maps of the United States were developed to show lines of constant summer evapotranspiration and constant summer precipitation. Figures 27 and 28 are illustrations of these maps with latitude and longitude grid lines drawn at 1-degree increments. Climatic values at each grid point and the coordinates of the grid point were transferred to keypunch data sheets. The grid points recorded were for the entire United States, including those grid points one degree outside the borders of the country. The following subgroup name card controls the system input of the climatic data:

EVAPTRAN

A sample of the climatic data, as contained in complete form in the library, is shown below.

LATD 48. LONG 67. RAIN 9. EVAP 12.

The data identification names shown have the following meanings:

EVAP: Value of summer potential evapotranspiration (inches)

LATD: Latitude of grid point (degrees)

LONG: Longitude of grid point (degrees)

RAIN: ...ue of summer precipitation (inches) at the grid point

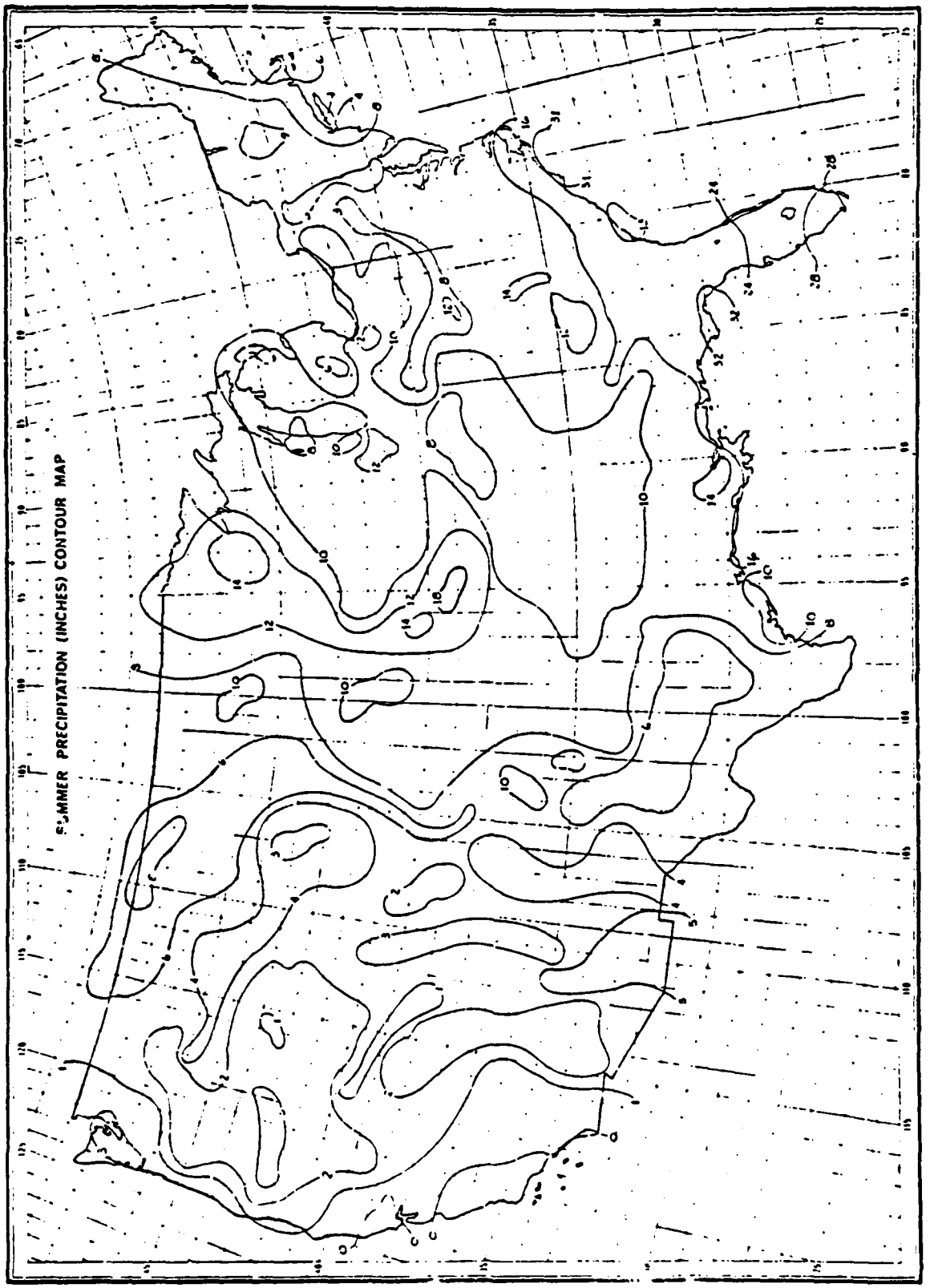


Figure 27. Lines of Constant Summer Precipitation

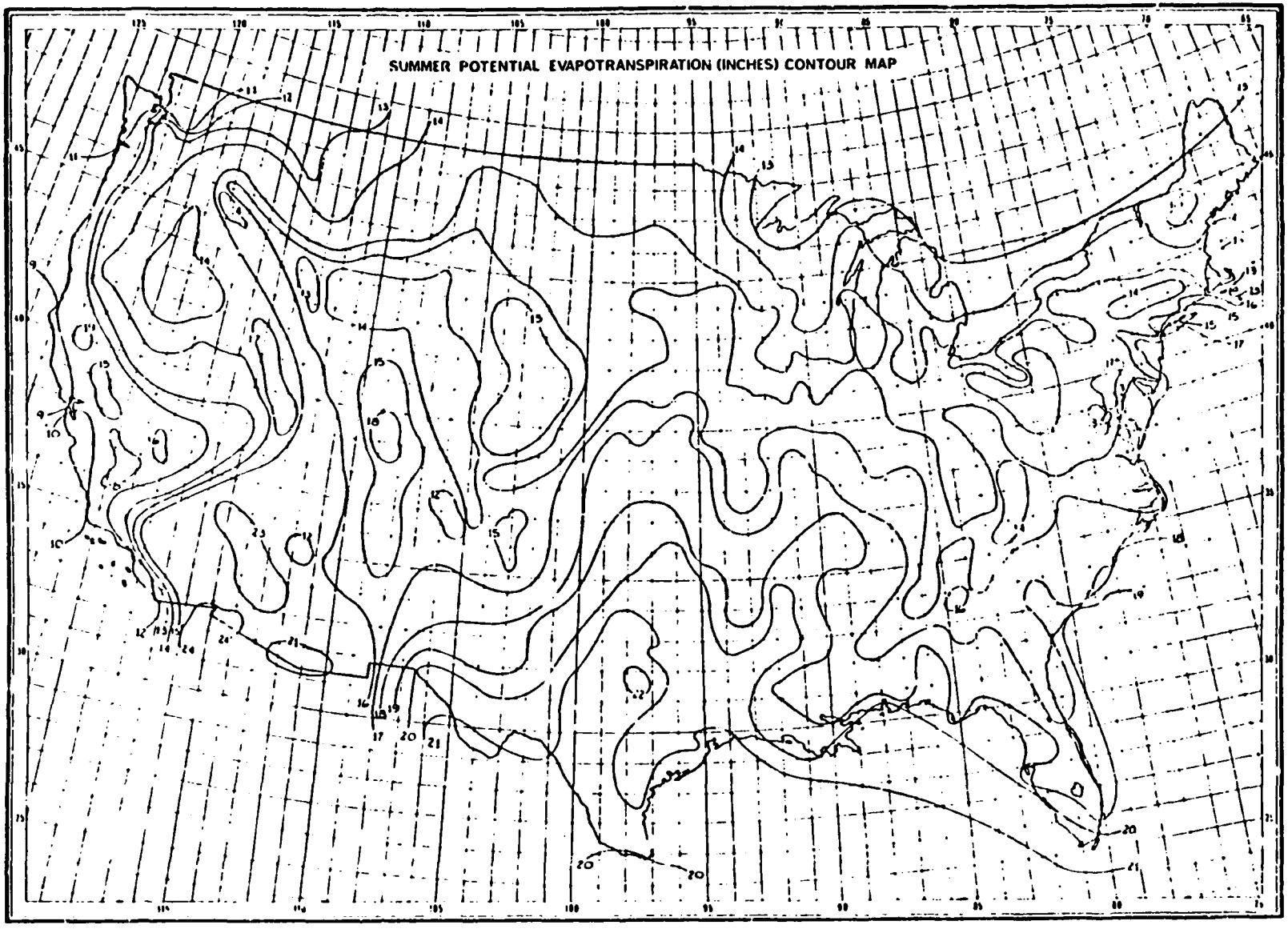


Figure 28. Lines of Constant Summer Potential Evapotranspiration

UPDATING AND MODIFYING THE LIBRARY

Users of the MAIN II System may find that the library does not contain up-to-date usage coefficient values nor adequate category definitions that satisfy local requirements. These users may make changes to the library file.

The data in the library file may be altered and modified as indicated below.

It is expected that users will be making library modifications to only the commercial, industrial, and public/unaccounted submodels. Changes to the residential equation constants and the climatic data are possible but not likely to occur, and such changes are therefore not shown in this report. Changes to existing category labels on usage coefficients may be incorporated on the file prepared from the tape, or the changes can be indicated on additional lines and placed in the proper data subgroup prepared from the tape. These additional lines should be placed just before the ENDD card in the data subgroup. It is also possible to modify the library by creating additional new data subgroups containing only the new sets of data cards. This latter feature is illustrated below.

Commercial Modifications

Assume that a user wishes to change the usage coefficients for the commercial category retail space and to open the two new categories, nonresident college and shopping center. The following tabulation lists the figures that illustrate how the added commercial data subgroups may look:

Figure No.	Illustration of
29	New commercial category labels
30	Parameter unit labels for the new commercial categories
31	New or corrected mean-annual usage coefficients
32	New or corrected maximum-day usage coefficients
33	New or corrected peak-hour usage coefficients

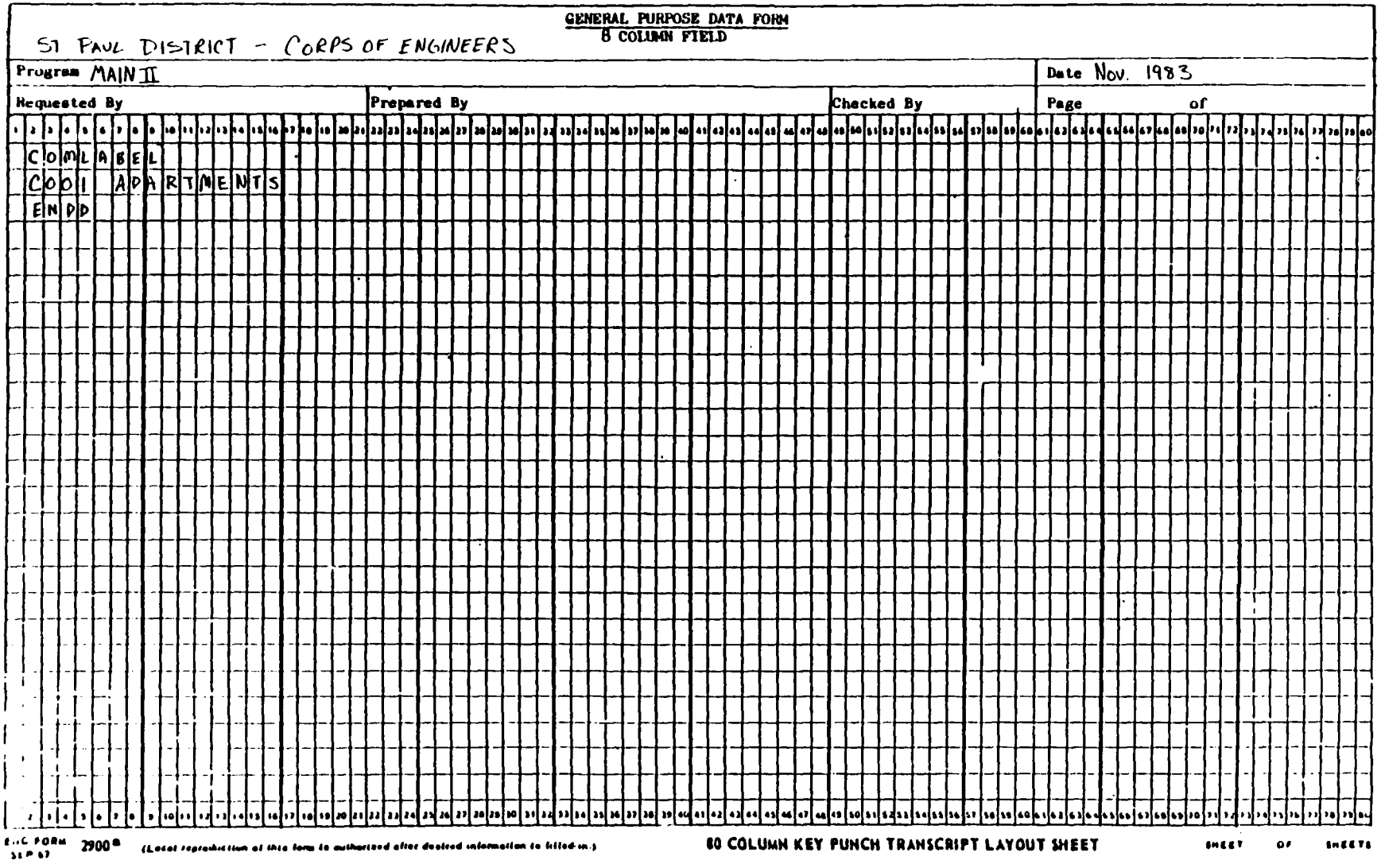


Figure 29. Modifications to Commercial Labels

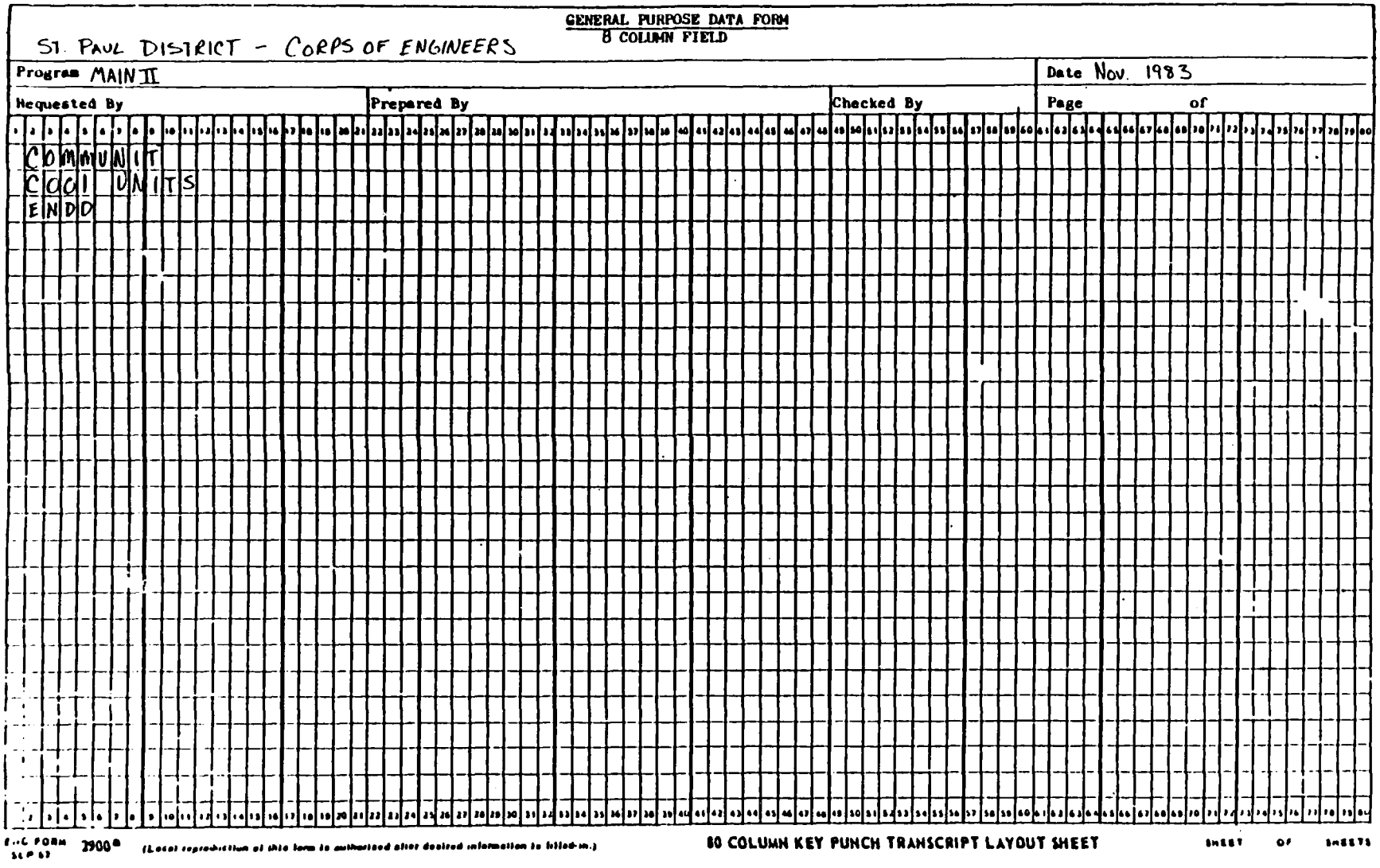


Figure 30. Modifications to Commercial Parameter Unit Labels

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
COMMAVE6
C001                    99.067
END
```

ENG FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 31. Modifications to Commercial Mean-Annual Usage Coefficients

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
COMMAXDY
C001                                99.100
ENDD
```

FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 32. Modifications to Commercial Maximum-Day Usage Coeffients

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT -- CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
COMMPEAK
COOL                    99.000
END
```

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

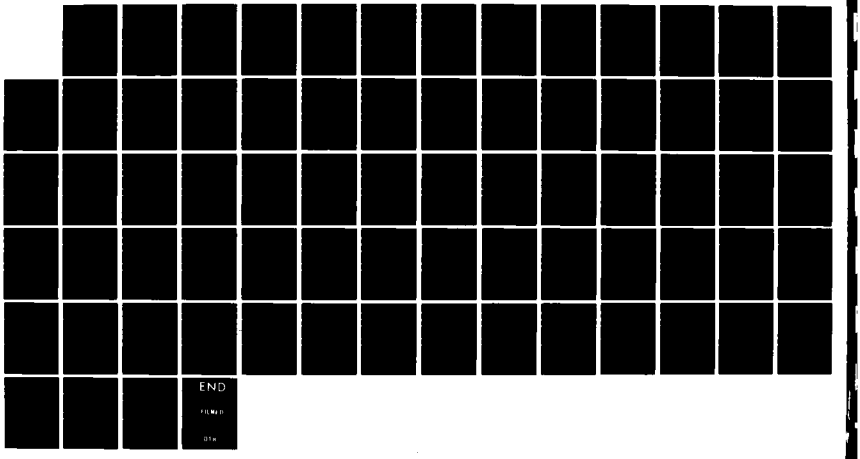
2900 B (Local reproduction of this form is authorized after desired information is filled in.)

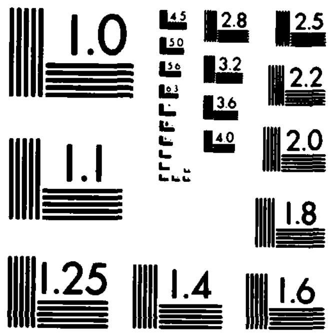
SHEET OF SHEETS

Figure 33. Modifications to Commercial Peak-Hour Usage Coefficients

AD-A150 058 MUNICIPAL AND INDUSTRIAL NEEDS (MAIN II) ST PAUL DISTRICT REVISION(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT B CARLSON ET AL. JAN 84 2/2

UNCLASSIFIED F/G 8/8 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Industrial Modification

To illustrate modifications to the industrial submodel, assume that water usage coefficients have been determined for the cigar industry, whose three-digit S.I.C. code might be 212. These data could be incorporated in the library with the examples of new data subgroups, as tabulated below:

Figure No.	Illustration of
34	New industrial category label
35	New mean-annual usage coefficient
36	New maximum-day usage coefficient
37	New peak-hour usage coefficient

To illustrate modifications to the industrial submodel that would facilitate data for individual industries, rather than industries grouped by S.I.C. code, assume that four industries are in the study area. If utility records of water use are available, a parameter (employees, pounds of product, etc.) that correlates with water use can be selected, and a use parameter can be created. These parameters, along with industry labels, can be incorporated in the library, as indicated below:

Figure No.	Illustration of
38	Modifications to industrial category label
39	Modifications to mean-annual usage coefficient
40	Modifications to maximum-day usage coefficient
41	Modifications to peak-hour usage coefficient

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

St Paul District Corps of Engineers

Program MAINT

Date NOV 1982

Requested By

Prepared By

Checked By

Page of

MAINT
12
CEGAR
ENV

Figure 34. New Industrial Category Labels

GENERAL PURPOSE DATA FORM

8 COLUMN FIELD

St Paul District Corps of Engineers

Program MAIN II

Date Nov 1983

Requested By

Prepared By

Checked By

Page of

```
ENDANAYE
I212           1472.312
ENI1
```

E.C FORM 2100 SEP 61 (Local reproduction of this form is authorized after desired information is filled-in.)

Figure 35. New Mean-Annual Usage Coefficients

SHEET OF SHEETS

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

Program HARDY

Requested By

Prepared By

Checked By

Date Nov 1982

Page of

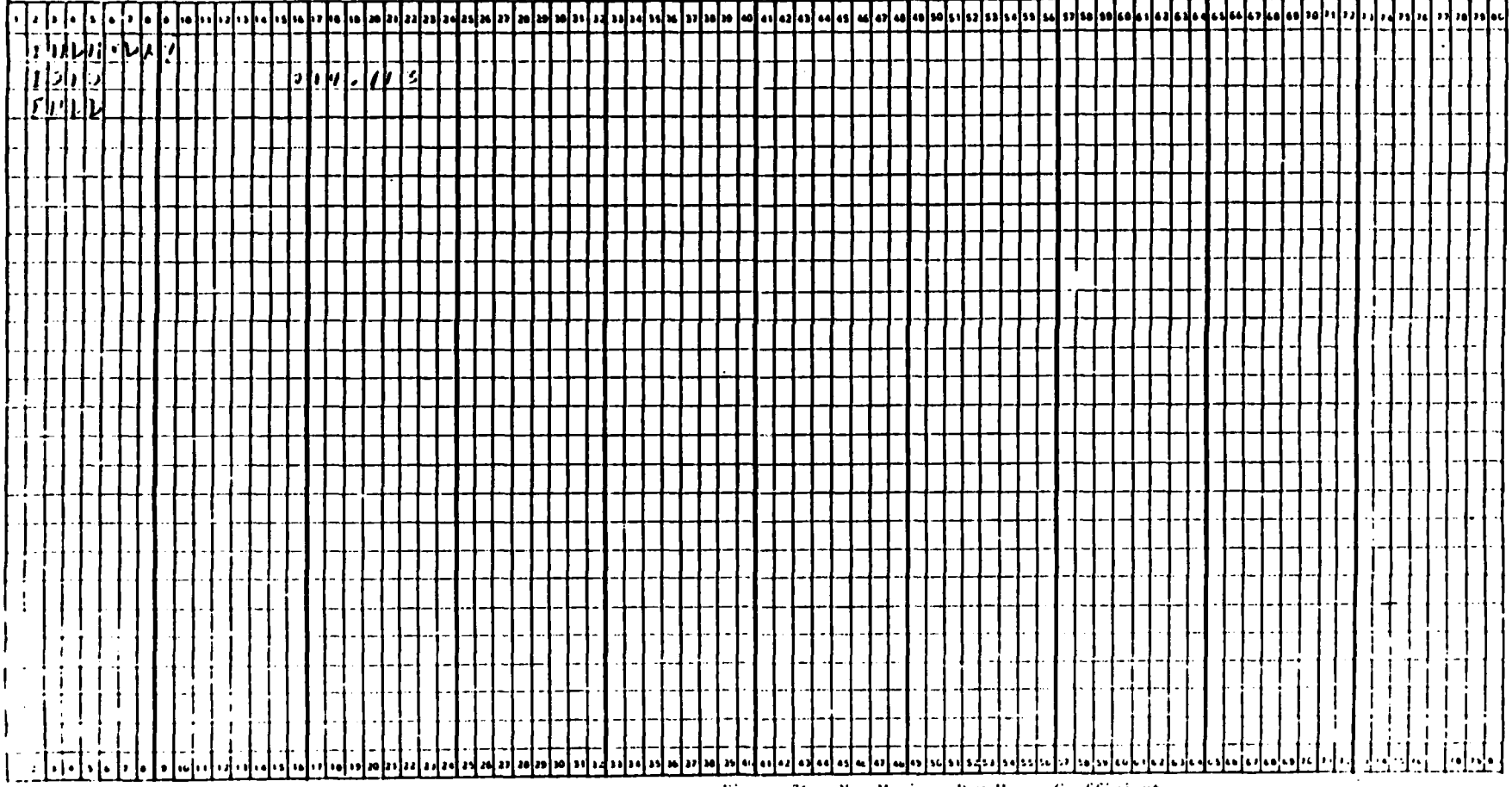


Figure 36. New Maximum-Day Usage Coefficients

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

St Paul District Corps of Engineers

Program MAIN II

Date Nov 1983

Requested By

Prepared By

Checked By

Page of

LNDUFKHS
2212
FHDD 251.932

ENG FORM 2900 SEP 67 (Local reproduction of this form is authorized after desired information is filled-in.)

Figure 37. New Peak-Hour Usage Coefficients

SHEET OF SHEETS

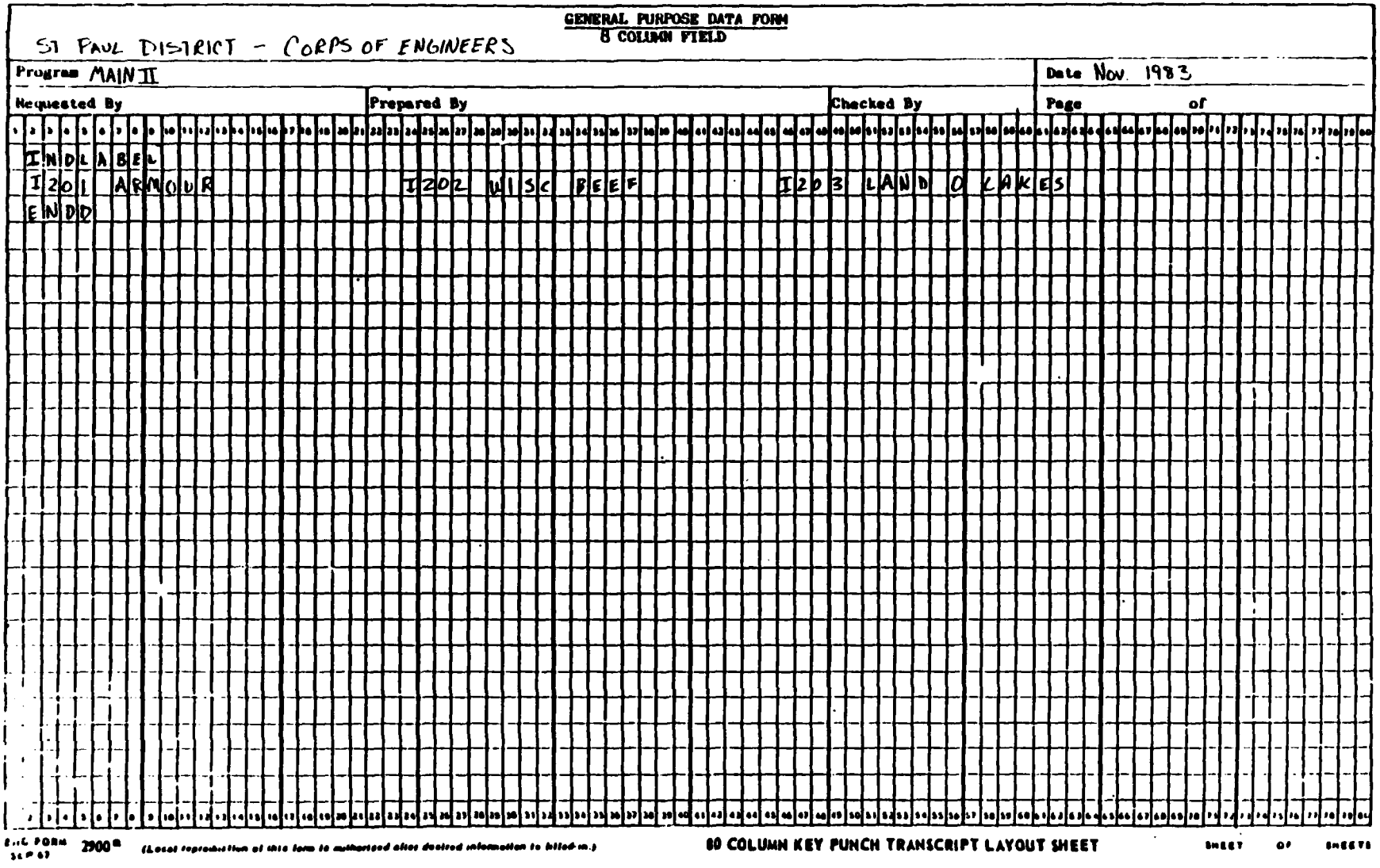


Figure 38. Modifications to Industrial Category Labels

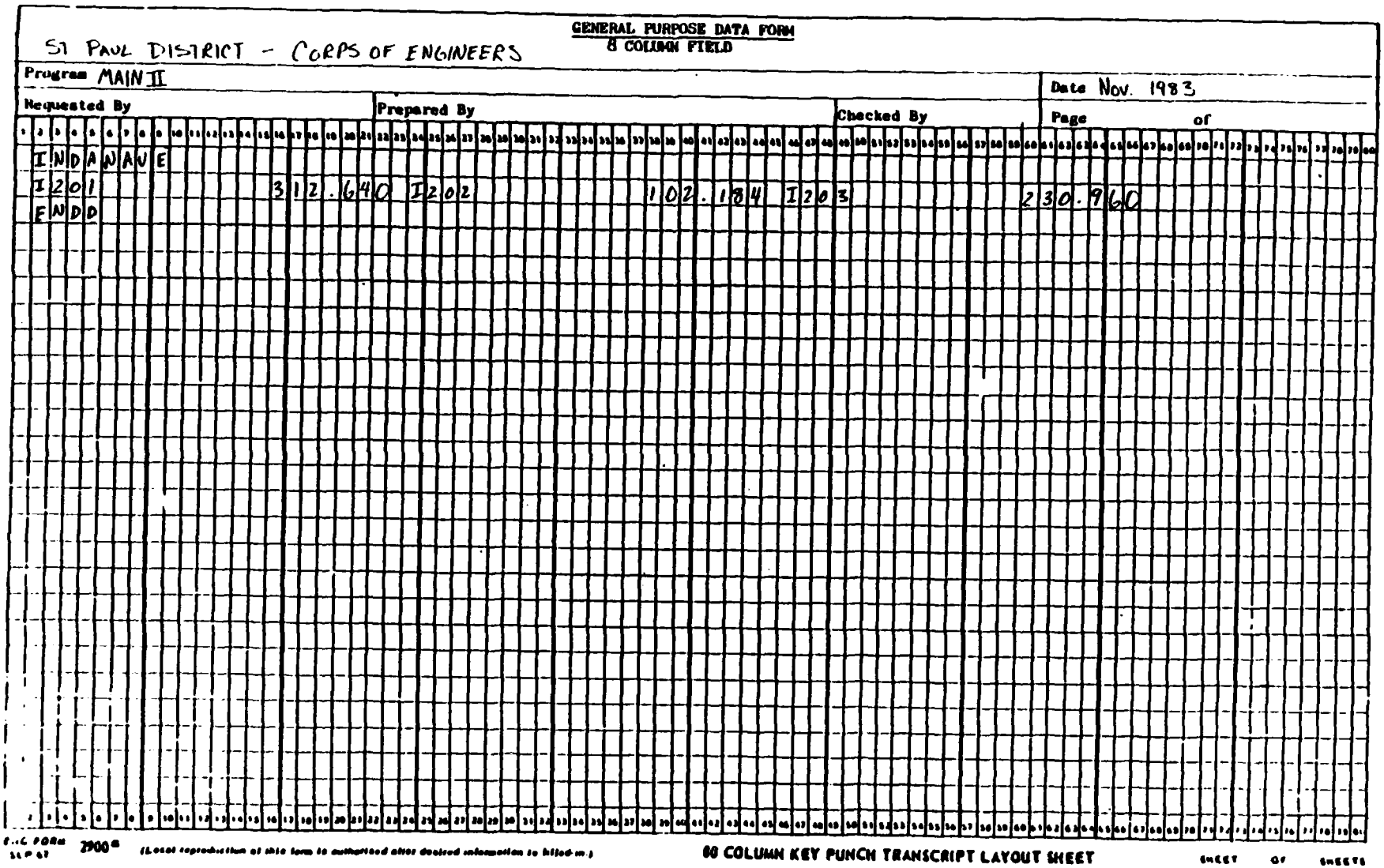


Figure 39. Modifications to Industrial Mean-Annual Usage Coefficients

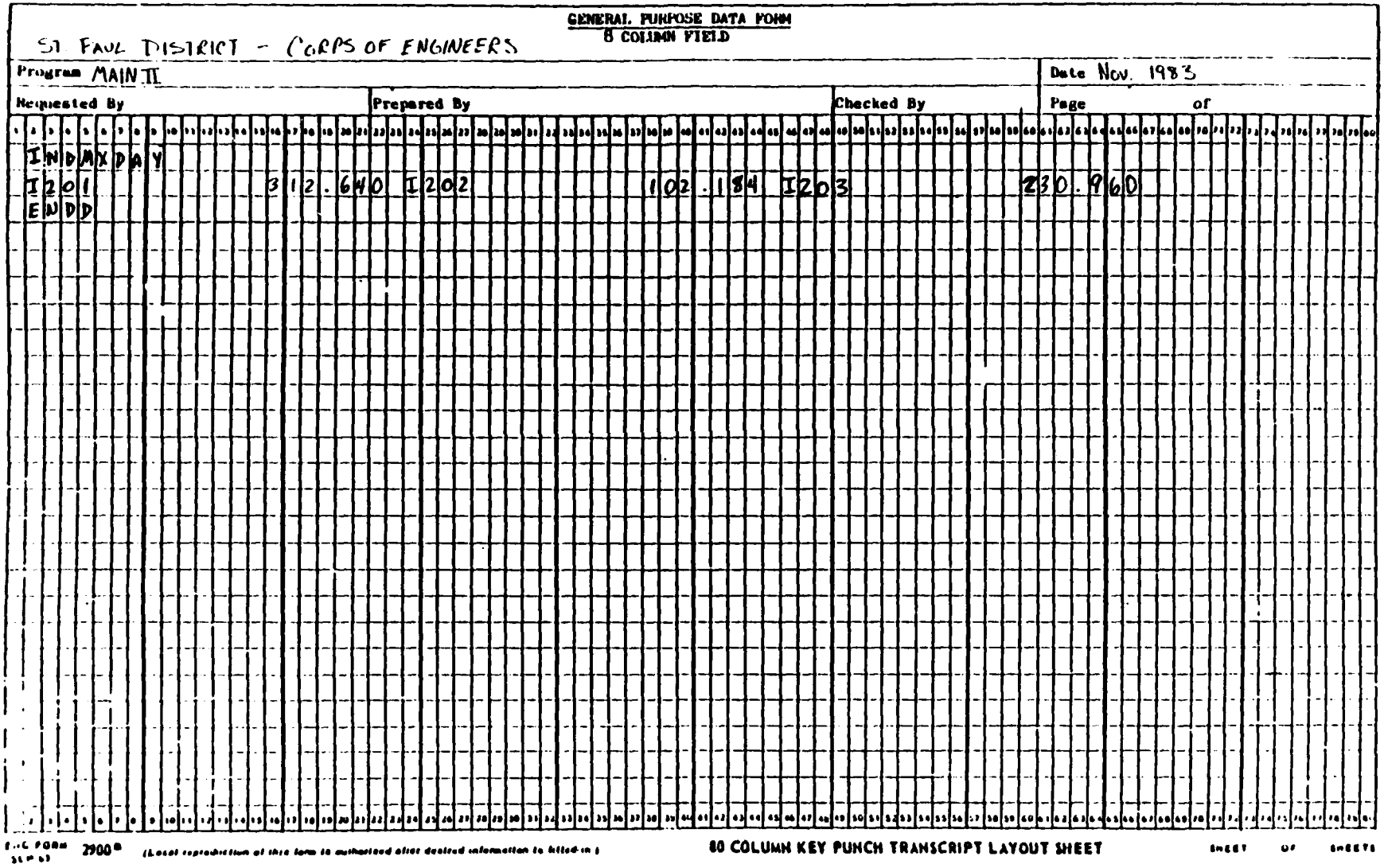


Figure 40. Modifications to Industrial Maximum-Day Usage Coefficients

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
INDPEKHR
I201                 416.800 I202                 429.170 I203                 230.960
ENDD
```

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

Figure 41. Modifications to Industrial Peak-Hour Usage Coefficients

Public/Unaccounted Modifications

For this illustration, assume that the user wants to change the usage coefficients for the distribution losses category and to open the new categories of street cleaning and firefighting. A tabulation of the examples of the new public/unaccounted data subgroups follows:

Figure No.	Illustration of
42	New public/unaccounted category labels
43	Modifications to mean-annual usage coefficients
44	Modifications to maximum-day usage coefficients
45	Modifications to peak-hour usage coefficients

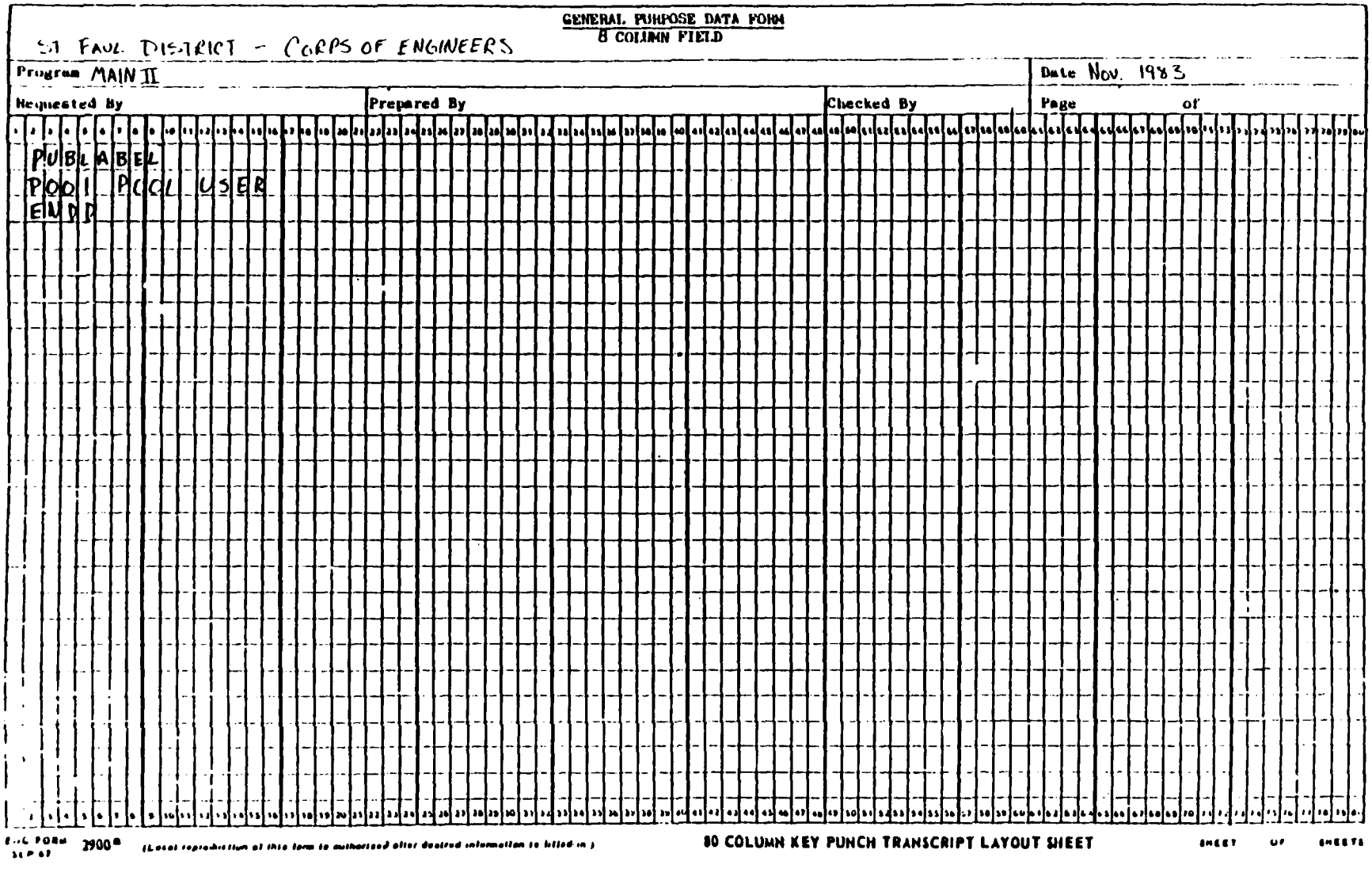


Figure 42. Modifications to Public/Unaccounted Category Labels

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
PUBCOFAA
P001                5.000
ENDD
```

ENG FORM 3100 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

Figure 43. Modifications to Public/Unaccounted Mean-Annual Usage Coefficients

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
PUBCOFMD
P001                5.000
ENDD
```

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

Figure 44. Modifications to Public/Unaccounted Maximum-Day Usage Coefficients

GENERAL PURPOSE DATA FORM
8 COLUMN FIELD

ST PAUL DISTRICT - CORPS OF ENGINEERS

Program MAIN II | Date Nov. 1983

Requested By | Prepared By | Checked By | Page of

```
PUBCOFPH
P001                5.000
END
```

FORM 2900 (Local reproduction of this form is authorized after desired information is filled in.)

80 COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

Figure 45. Modifications to Public/Unaccounted Peak-Hour Usage Coefficients

CHAPTER IV: SYSTEM OUTPUT REPORTS

GENERAL DESCRIPTION

The printed output generated by the MAIN II System computer program is determined by the data provided to the system, except the listing of the Library of Water Usage Coefficients, which can be separately controlled by the user. The system generates up to nine reports for each year analyzed, plus a single summary of all years. A complete list of all possible system-generated reports is tabulated below:

1. Residential water requirements - metered and sewered areas
2. Residential water requirements - flat rate and sewered areas
3. Residential water requirements - metered and septic tank areas
4. Residential water requirements - flat rate and septic tank areas
5. Residential water requirements - summary of all areas
6. Commercial water requirements - categories and summary
7. Industrial water requirements - categories and summary
8. Public/unaccounted water requirements - categories and summary
9. Municipal summary report
10. Forecast summary report

A sample of the printed output and the associated data file is in appendix A.

RESIDENTIAL REPORTS

The MAIN II System contains four categories of residential water use:

1. Metered-sewered residences
2. Flat rate-sewered residences
3. Metered-septic tank residences
4. Flat rate-septic tank residences

A particular urban area may require one or more of these categories. Reports are generated for those categories actually present and for which water requirements are calculated.

The detailed residential water requirement report for the metered and sewered areas is identical with reports that may be generated for the other three categories. The value ranges indicated are those provided by the user and are in terms of assessed value or market value, whichever was provided. The number of units is the total number of residences in each value group, as provided by the user if current requirements are being reported, or as projected by the system for predicted water requirements reports. The last five columns detail water requirements in terms of gallons per day. Domestic water uses refer to all uses within the home itself, while sprinkling uses include all outside or seasonal uses. The sum of the two is the total annual average requirement, which is followed by estimates of requirements for the maximum day of the year and the peak hour of the year. The last line presents totals for all columns.

Forecast reports have parameters labeled to indicate the method of growth applied to that parameter. The parameters are labeled in the following way:

1. Projection by population (default - no label)
2. External projection by direct input (E)
3. Historical trend extrapolation (H)

The residential summary report lists totals of mean-annual, maximum-day, and peak-hour requirements, as detailed in the separate reports discussed above. All values are in gallons per day. Below the totals, a recapitulation of the requirements of each category, as given by totals on each category report, is presented, including the number of residential units in each category and their total. The final entries

on the report are the climatic data used in computing water requirements, as determined from data contained in the Library of Water Usage Coefficients.

COMMERCIAL/INSTITUTIONAL REPORTS

The commercial water requirements report contains both summary and detailed information on water use for 28 categories of commercial establishments and institutions, as well as for any categories added by the user. Near the top of the report, total commercial/institutional requirements are shown, in gallons per day, for the annual average, the maximum day, and the peak hour. These values are the totals of the detailed categories listed in the report.

Each commercial/institutional category is identified by a name under the "TYPE" heading, followed by the designation of the units of the water-use parameter. For example, the parameter for hotels and motels is square feet of floor space, while for barber shops it is the number of barber chairs. The third column displays the number of units, or the value of the water-use parameter for the year of the report. When current requirements are being estimated, this value is provided by the user, but it is projected by the system for forecasts of future years. The remaining three columns list mean-annual, maximum-day, and peak-hour requirements for each category.

INDUSTRIAL REPORTS

Like the commercial/institutional report, the industrial water requirements report contains both summary and detail information on industrial water use in specific categories. The summary of industrial water requirements appears at the top of the report, giving estimates

of mean-annual, maximum-day, and peak-hour use, all in gallons per day. These estimates are totals of the individual category estimates listed in the report.

The MAIN II System Library of Water Usage Coefficients contains coefficients for 105 three-digit S.I.C. categories of manufacturing industry. The name of the industry classification follows the S.I.C. number. The next column contains the value of the water-use parameter for each category, which, in the case of industrial categories, is the number of employees for each three-digit S.I.C. number. These values are either those provided by the user or values projected by the system, for base year or projection year reports, respectively. Finally, the mean-annual, maximum-day, and peak-hour requirements estimates are listed.

PUBLIC/UNACCOUNTED REPORTS

The public/unaccounted sector of the MAIN II System consists of three built-in categories: distribution losses, free services, and airports, plus any additional categories that might be added by the user. The public/unaccounted water requirements report contains a summary of public/unaccounted requirements, followed by details according to category. The summary information consists of mean-annual, maximum-day, and peak-hour use, given in gallons per day. These quantities are the totals of the category estimates listed in the report.

MUNICIPAL SUMMARY REPORTS

The output reports described in this chapter appear only when water requirements in the related sector of the community are actually calculated. These calculations, in turn, are determined by the provision of the required input data for each category. The municipal summary report, however, is printed, regardless of the sectors reported

elsewhere. The first line of this report is the estimate of municipal, or total, water requirements for the study year. The municipal mean-annual use is the total of the annual average for each sector listed below it, which, in turn, is the total from the individual summary reports. The municipal maximum-day use is not a simple total, however. It is the sum of the maximum day for a single sector of water use and the annual averages for the remaining sectors that give the largest value. The same procedure is followed for peak-hour requirements.

FORECAST SUMMARY REPORTS

The forecast summary report appears whenever the MAIN II System is used to forecast municipal water requirements. If the system is used to estimate requirements for the current year only, the municipal summary report constitutes the final summary. When more than one year is involved, however, as in forecasting, it is desirable to compare the final results for the various years. Each year is listed after the related run number, with mean-annual, maximum-day, and peak-hour requirements indicated. The run numbers specify the order of input. The results are listed in the order of input so that the effect of the alternative methods can be evaluated. The forecast summary report will list water requirements for up to 25 years, including the base year.

APPENDIX A

SAMPLE DATA FILE

PART I: TEST DATA FILE

```
CITYDATA
EAU CLAIRE, WISCONSIN
COAT          1982.000
LATD            44.490
LONG            91.310
POPU         51509.000
ENDI
METRSEWR
VALN          5000.000
VALX         10000.000
ANPR           188.500
DENS             8.000
NUMB           240.000
PEPL             2.400
SMPR           147.500
VALN         10001.000
VALX         20000.000
ANPR           188.500
DENS             8.000
NUMB          2537.000
PEPL             2.400
SMPR           147.500
VALN         20001.000
VALX         25499.000
ANPR           188.500
DENS             7.000
NUMB          1697.000
PEPL             2.400
SMPR           147.500
VALN         25500.000
VALX         30000.000
ANPR           188.500
DENS             7.000
NUMB          1558.000
PEPL             2.400
SMPR           147.500
VALN         30001.000
VALX         40000.000
ANPR           188.500
DENS             7.000
NUMB          3343.000
PEPL             2.700
SMPR           147.500
VALN         40001.000
VALX         49999.000
ANPR           188.500
DENS             7.000
NUMB          2790.000
PEPL             2.900
SMPR           147.500
VALN         51000.000
```

VALX	80000.000
ANPR	188.500
DENS	6.000
NUMB	1512.000
PEPL	3.050
SMPR	147.500
VALN	60001.000
VALX	70000.000
ANPR	189.500
DENS	6.000
NUMB	796.000
PEPL	3.100
SMPR	147.500
VALN	70001.000
VALX	80000.000
ANPR	188.500
DENS	6.000
NUMB	343.000
PEPL	3.200
SMPR	147.500
VALN	80001.000
VALX	90000.000
ANPR	188.500
DENS	6.000
NUMB	161.000
PEPL	3.500
SMPR	147.500
VALN	90001.000
VALX	99999.000
ANPR	188.500
DENS	5.000
NUMB	93.000
PEPL	3.800
SMPR	147.500
VALN	100000.000
VALX	125000.000
ANPR	188.500
DENS	5.000
NUMB	112.000
PEPL	3.800
SMPR	147.500
LOWV	3.000
MEDN	3.000
HIGH	6.000
ENDC	
COMMPARM	
MOTL	106015.000
MOTL	512874.000
BARB	50.000
BEUT	165.000

EATN	5500.000
EATO	400.000
NITE	400.000
POST	663.000
NURE	487.000
MEDL	103842.000
LNDY	23042.000
LNDM	17613.000
SALE	3205701.000
DPOT	2160.000
CARW	13548.000
CHUR	30000.000
CLUB	1000.000
BOWL	74.000
OFFN	412374.000
OFFO	395590.000
JAIL	80.000
THTR	3512.000
YMCA	9349.000
BASS	70438.000
C001	4500.000
ENDD	
INDPARAM	
I201	225.000
I202	300.000
I203	100.000
I204	30.000
I205	26.000
I206	95.000
I207	40.000
I208	30.000
I209	227.000
I210	700.000
I211	100.000
I212	55.000
I213	6.000
I214	1500.000
I215	100.000
I216	30.000
I217	90.000
I218	30.000
I219	200.000
I220	111.000
I221	40.000
I222	26.000
I223	21.000
I224	250.000
ENDD	
PUBANAVE	
LOSS	857684.000

```
FSER          511225.000
ENDD
PUBMAXD
LOSS          857684.000
FSER          511225.000
ENDD
PUBPERHF
LOSS          857684.000
FSER          511225.000
ENDD
NEWYEAR
YEAR            1992.000
POPU           65755.000
ENDD
ENDYEAR
NEWYEAR
YEAR            2002.000
POPU           80000.000
ENDD
ENDYEAR
NEWYEAR
YEAR            1992.000
POPU           65755.000
ENDD
INDPROJT
I201             170.000
I202             267.000
I205              72.000
I207              40.000
I210             700.000
I214            1625.000
I219             240.000
I222              50.000
I223              60.000
I224             400.000
ENDD
INDEFF
I205              .700
I214              .700
ENDD
INDPROD
ENDD
COMFPARM
HCSF             663.000.
MEDL          207684.000
ENDD
HCOMPARM
ENDD
NUMHOMES
MWLO            4893.000
```

```
MWMD          9729.000
MWHI          4866.000
ENDD
PUBANAVE
LOSS        975250.000
FSER        511225.000
ENDD
PUBMAXDY
LOSS        975250.000
FSER        511225.000
ENDD
PUBPEKHR
LOSS        975250.000
FSER        511225.000
ENDD
ENDYEAR
ENDINPUT
```

PART II: TEST DATA FILE OUTPUT

```
REDINP  CITYDATA


    CITY  DATA


EAU CLAIRE, WISCONSIN
CDAT          1982.000          0.000          0.000
LATD            44.490          0.000          0.000
LONS            91.310          0.000          0.000
POPU         51509.000          0.000          0.000
ENDD             0.000          0.000          0.000
REDINP  METRSEWR


VALN          5000.000          0.000          0.000
VALX         10000.000          0.000          0.000
ANPR           188.500          0.000          0.000
DENS             8.000          0.000          0.000
NUMB           240.000          0.000          0.000
PEPL             2.400          0.000          0.000
SMPR           147.500          0.000          0.000
VALN         10001.000          0.000          0.000
VALX         20000.000          0.000          0.000
ANPR           188.500          0.000          0.000
DENS             8.000          0.000          0.000
NUMB          2537.000          0.000          0.000
PEPL             2.400          0.000          0.000
SMPR           147.500          0.000          0.000
VALN         20001.000          0.000          0.000
VALX         25499.000          0.000          0.000
ANPR           188.500          0.000          0.000
DENS             7.000          0.000          0.000
NUMB          1697.000          0.000          0.000
PEPL             2.400          0.000          0.000
SMPR           147.500          0.000          0.000
VALN         25500.000          0.000          0.000
VALX         30000.000          0.000          0.000
ANPR           188.500          0.000          0.000
DENS             7.000          0.000          0.000
NUMB          1558.000          0.000          0.000
PEPL             2.400          0.000          0.000
SMPR           147.500          0.000          0.000
VALN         30001.000          0.000          0.000
VALX         40000.000          0.000          0.000
ANPR           188.500          0.000          0.000
DENS             7.000          0.000          0.000
```

NUME	3343.000	0.000	0.000
PEPL	2.700	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	40001.000	0.000	0.000
VALX	49999.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	7.000	0.000	0.000
NUMB	2790.000	0.000	0.000
PEPL	2.900	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	51000.000	0.000	0.000
VALX	60000.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	6.000	0.000	0.000
NUMB	1512.000	0.000	0.000
PEPL	3.050	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	60001.000	0.000	0.000
VALX	70000.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	6.000	0.000	0.000
NUMB	786.000	0.000	0.000
PEPL	3.100	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	70001.000	0.000	0.000
VALX	80000.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	6.000	0.000	0.000
NUMB	343.000	0.000	0.000
PEPL	3.200	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	80001.000	0.000	0.000
VALX	90000.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	6.000	0.000	0.000
NUMB	161.000	0.000	0.000
PEPL	3.500	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	90001.000	0.000	0.000
VALX	99999.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	5.000	0.000	0.000
NUMB	73.000	0.000	0.000
PEPL	3.800	0.000	0.000
SMPR	147.500	0.000	0.000
VALN	100000.000	0.000	0.000
VALX	125000.000	0.000	0.000
ANPR	188.500	0.000	0.000
DENS	5.000	0.000	0.000
NUMB	112.000	0.000	0.000

PEPL	3.800	0.000	0.000
SMPR	147.500	0.000	0.000
LOWV	3.000	0.000	0.000
MEDN	3.000	0.000	0.000
HIGH	6.000	0.000	0.000
ENDD	0.000	0.000	0.000

REDINP COMMPARM

HOTL	106015.000	0.000	0.000
MOTL	512874.000	0.000	0.000
BARB	50.000	0.000	0.000
BEUT	165.000	0.000	0.000
EATN	5500.000	0.000	0.000
EATO	400.000	0.000	0.000
NITE	400.000	0.000	0.000
HOSP	663.000	0.000	0.000
NURS	487.000	0.000	0.000
MEDL	103842.000	0.000	0.000
LNDY	23042.000	0.000	0.000
LNDM	17813.000	0.000	0.000
SALE	3205701.000	0.000	0.000
DPOT	2160.000	0.000	0.000
CARW	13548.000	0.000	0.000
CHUR	30000.000	0.000	0.000
CLUB	1000.000	0.000	0.000
BOWL	74.000	0.000	0.000
OFFN	412374.000	0.000	0.000
OFFO	395590.000	0.000	0.000
JAIL	80.000	0.000	0.000
THTR	3512.000	0.000	0.000
YMCA	9349.000	0.000	0.000
GASS	70438.000	0.000	0.000
C001	4500.000	0.000	0.000
ENDD	0.000	0.000	0.000

REDINP INDPARAM

I201	225.000	0.000	0.000
I202	300.000	0.000	0.000
I203	100.000	0.000	0.000
I204	30.000	0.000	0.000
I205	26.000	0.000	0.000
I206	95.000	0.000	0.000
I207	40.000	0.000	0.000
I208	30.000	0.000	0.000
I209	227.000	0.000	0.000
I210	700.000	0.000	0.000

```
I211          100.000          0.000          0.000
I212           55.000          0.000          0.000
I213            6.000          0.000          0.000
I214         1500.000          0.000          0.000
I215          100.000          0.000          0.000
I216           30.000          0.000          0.000
I217           90.000          0.000          0.000
I218           30.000          0.000          0.000
I219          200.000          0.000          0.000
I220          111.000          0.000          0.000
I221           40.000          0.000          0.000
I222           26.000          0.000          0.000
I223           21.000          0.000          0.000
I224          250.000          0.000          0.000
ENDD            0.000          0.000          0.000
REDINP  PUBANAVE


LOSS       857684.000          0.000          0.000
FSER       511225.000          0.000          0.000
ENDD            0.000          0.000          0.000
REDINP  PUBMAXDY


LOSS       857684.000          0.000          0.000
FSER       511225.000          0.000          0.000
ENDD            0.000          0.000          0.000
REDINP  PUBPEKHR


LOSS       857684.000          0.000          0.000
FSER       511225.000          0.000          0.000
ENDD            0.000          0.000          0.000
REDINP  NEWYEAR


YEAR          1992.000          0.000          0.000
POPU         65755.000          0.000          0.000
ENDD            0.000          0.000          0.000
ENDYEAR
REDINP  NEWYEAR


YEAR          2002.000          0.000          0.000
POPU         80000.000          0.000          0.000
```

ENDD	0.000	0.000	0.000
ENDYEAR			
BEGINF NEWYEAR			
YEAR	1992.000	0.000	0.000
POPU	65755.000	0.000	0.000
ENDD	0.000	0.000	0.000
INDPROJT			
I201	170.000	0.000	0.000
I202	267.000	0.000	0.000
I205	72.000	0.000	0.000
I207	40.000	0.000	0.000
I210	700.000	0.000	0.000
I214	1625.000	0.000	0.000
I219	240.000	0.000	0.000
I222	50.000	0.000	0.000
I223	60.000	0.000	0.000
I224	400.000	0.000	0.000
ENDD	0.000	0.000	0.000
INDEFF			
I205	0.700	0.000	0.000
I214	0.700	0.000	0.000
ENDD	0.000	0.000	0.000
INDPROD			
ENDD	0.000	0.000	0.000
COMFPARM			
HOSP	663.000	0.000	0.000
MEDL	207684.000	0.000	0.000
ENDD	0.000	0.000	0.000
HCOMPARM			
ENDD	0.000	0.000	0.000
NUMHOMES			
MWLO	4893.000	0.000	0.000
MWMD	9789.000	0.000	0.000
MWHI	4686.000	0.000	0.000
ENDD	0.000	0.000	0.000
PUBANAVE			
LOSS	975250.000	0.000	0.000
FSER	511225.000	0.000	0.000
ENDD	0.000	0.000	0.000
PUBMAXDY			
LOSS	975250.000	0.000	0.000
FSER	511225.000	0.000	0.000
ENDD	0.000	0.000	0.000
PUBPERHR			
LOSS	975250.000	0.000	0.000
FSER	511225.000	0.000	0.000
ENDD	0.000	0.000	0.000

```
ENDYEAR
BEGINP  ENDINPUT
```

MU ICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1982

ANALYZED BY MAIN SYSTEM

CURRENT RESIDENTIAL WATER REQUIREMENTS BY CATEGORY
METERED AND SEWERED AREAS
AVERAGE ANNUAL

VALUE RANGE ($)	NO. OF UNITS	DOMESTIC	SPRINKLING	TOTAL	MAX DAY	PEAK HOUR
5000. - 10000.	240.	30556.	433.	30989.	43052.	166995.
0001. - 20000.	2537.	346709.	12511.	359220.	598563.	2054659.
0001. - 25499.	1697.	248300.	13396.	261696.	501537.	1578398.
5500. - 30000.	1558.	237668.	16404.	254073.	517399.	1563966.
0001. - 40000.	3343.	540166.	49284.	589450.	1285180.	3708771.
0001. - 49999.	2790.	485573.	59214.	544787.	1271243.	3495958.
1000. - 60000.	1512.	282931.	37286.	320217.	812518.	2143857.
0001. - 70000.	786.	156383.	24374.	180757.	475315.	1221234.
0001. - 80000.	343.	72517.	13089.	85606.	231529.	581555.
0001. - 90000.	161.	36045.	7366.	43411.	119907.	295627.
0001. - 99999.	93.	21980.	4167.	26147.	77183.	186740.
0000. - 125000.	112.	28912.	6413.	35325.	106727.	252677.
TOTAL	15172.	2487740.	243937.	2731678.	6040153.	17250437.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1982

ANALYZED BY MAIN SYSTEM

CURRENT RESIDENTIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
2731678.	6040153.	17250437.

REQUIREMENTS BY TYPE - ANNUAL AVERAGE

TYPE	NO. OF UNITS	GALLONS PER DAY DOMESTIC	SPRINKLING	TOTAL
METERED AND SEWERED AREAS	15172.	2487740.	243937.	2731678.
TOTAL	15172.	2487740.	243937.	2731678.

SUMMER EVAPOTRANSPIRATION (INCHES) = 13.75
SUMMER PRECIPITATION (INCHES) = 10.50
MAX. DAY EVAPOTRANSPIRATION (INCHES) = 0.29

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1982

ANALYZED BY. MAIN SYSTEM

TOTAL COMMERCIAL REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
1807892.	3173021.	8441911.

WATER REQUIREMENTS BY TYPE OF COMMERCIAL ESTABLISHMENT

TYPE	UNITS	NUMBER OF UNITS	MULT FACTOR	ADD FACTOR	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
					(GALLONS PER DAY)		
HOTELS	SQ. FT.	106015.	1.000	0.000	27140.	31168.	45904.
MOTELS	SQ. FT.	512874.	1.000	0.000	114884.	236435.	794955.
BARBER SHOPS	BARBER CHAIR	50.	1.000	0.000	2730.	4015.	19450.
BEAUTY SHOPS	STATION	165.	1.000	0.000	44385.	54120.	176550.
RESTAURANTS	SEAT	5500.	1.000	0.000	133100.	458700.	918500.
DRIVE-IN REST-NT	CAR SPACE	400.	1.000	0.000	43600.	57600.	218800.
NIGHT CLUBS	PERSON SERVED	400.	1.000	0.000	532.	532.	532.
HOSPITALS	BED	663.	1.000	0.000	217486.	365313.	604656.
NURSING HOMES	BED	487.	1.000	0.000	64771.	71102.	206488.
MEDICAL OFFICES	SQ. FT.	103842.	1.000	0.000	64174.	172378.	516095.
LAUNDRY	SQ. FT.	23042.	1.000	0.000	5830.	7512.	36176.
LAUNDROMATS	SQ. FT.	17813.	1.000	0.000	38654.	84434.	27966.
RETAIL SPACE	SALES SQ. FT.	3205701.	1.000	0.000	339804.	493678.	868745.
BUS-RAIL DEPOTS	SQ. FT.	2160.	1.000	0.000	7193.	14040.	54000.
CAR WASHES	INSIDE SQ. FT.	13548.	1.000	0.000	64759.	139544.	426762.
CHURCHES	MEMBER	30000.	1.000	0.000	4140.	25860.	141000.
GOLF-SWIM CLUBS	MEMBER	1000.	1.000	0.000	31000.	22200.	22200.
BOWLING ALLEYS	ALLEY	74.	1.000	0.000	9842.	9842.	9842.
NEW OFFICE BLDG.	SQ. FT.	412374.	1.000	0.000	38351.	71341.	214847.
OLD OFFICE BLDG.	SQ. FT.	395590.	1.000	0.000	56174.	32043.	140039.
JAIL & PRISONS	PERSON	80.	1.000	0.000	10640.	10640.	10640.
THEATERS	SEAT	3512.	1.000	0.000	11695.	11695.	11695.
YMCA-YWCA FACIL.	PERSON	9349.	1.000	0.000	13547.	311322.	311322.
SERVICE STATIONS	INSIDE SQ. FT.	70438.	1.000	0.000	17680.	41558.	2218797.
APARTMENTS	UNITS	4500.	1.000	0.000	445802.	445950.	445950.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1982

ANALYZED BY MAIN SYSTEM

TOTAL INDUSTRIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
3210037.	3530819.	3687998.

REQUIREMENTS BY TYPE OF INDUSTRY

ID #	INDUSTRY	NUMBER OF EMPLOYEES	PRODUCT.	EFFIC.	GALLONS/DAY ANNUAL AVERAGE	GALLONS/DAY MAXIMUM DAY	GALLONS/DAY PEAK HOUR
201	ARMOUR	225.	1.000	1.000	70344.	70344.	93780.
202	MISC BEEF	300.	1.000	1.000	30655.	30655.	128751.
203	LAND 'O LAKES	100.	1.000	1.000	23096.	23096.	23096.
204	MARIGOLD	30.	1.000	1.000	10813.	10813.	21626.
205	TOLONA PIZZA	26.	1.000	1.000	2050.	2050.	2050.
206	HOLSUM BAKERS	95.	1.000	1.000	11268.	11268.	11268.
207	COCA COLA	40.	1.000	1.000	1336.	1336.	1336.
208	WALTER BREW	30.	1.000	1.000	49668.	49668.	74502.
209	CAREER DEVELOP	227.	1.000	1.000	2551.	2551.	2551.
210	POPE & TALBOT	700.	1.000	1.000	1379217.	1699999.	1699999.
211	SHEDD BROWN	100.	1.000	1.000	15787.	15787.	15787.
212	JOHNSON LITHO	55.	1.000	1.000	4190.	4190.	4190.
213	JENNICO	6.	1.000	1.000	451.	451.	451.
214	UNIROYAL	1500.	1.000	1.000	1357395.	1357395.	1357395.
215	AM MATERIALS	100.	1.000	1.000	344.	344.	344.
216	AM. PRE-STRESS	30.	1.000	1.000	1890.	1890.	1890.
217	FEHR CONCRETE	90.	1.000	1.000	5288.	5288.	5288.
218	PHILLIPS, MAX	30.	1.000	1.000	2562.	2562.	2562.
219	PHOENIX STEEL	200.	1.000	1.000	13610.	13610.	13610.
220	GOULD	111.	1.000	1.000	19617.	19617.	19617.
221	N.W. MOTOR	40.	1.000	1.000	2079.	2079.	2079.
222	MCDONOUGH MFG	26.	1.000	1.000	385.	385.	385.
223	HUTCHENS INDSTY	21.	1.000	1.000	277.	277.	277.
224	MEMOREX	250.	1.000	1.000	205165.	205165.	205165.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1982

ANALYZED BY MAIN SYSTEM

TOTAL PUBLIC-UNACCOUNTED REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
1368909.	1368909.	1368909.

REQUIREMENTS BY TYPE OF PUBLIC-UNACCOUNTED USAGE IN GALLONS PER DAY

TYPE	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
DISTRIB. LOSSES	857684.	857684.	857684.
FREE SERVICES	511225.	511225.	511225.

SUMMARY OF MUNICIPAL WATER REQUIREMENTS FOR CITY OF EAU CLAIRE, WISCONSIN

ESTIMATED WATER REQUIREMENTS FOR YEAR 1982.
(ALL VALUES IN GALLONS PER DAY)

	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
MUNICIPAL	9118515.	12426991.	23637275.
RESIDENTIAL	2731678.	6040153.	17250437.
COMMERCIAL	1807892.	3173021.	8441911.
INDUSTRIAL	3210037.	3530819.	3687998.
PUBLIC AND UNACC.	1368909.	1368909.	1368909.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

PREDICTED RESIDENTIAL WATER REQUIREMENTS BY CATEGORY
METERED AND SEWERED AREAS
AVERAGE ANNUAL

VALUE RANGE ($)	NO. OF UNITS	DOMESTIC	SPRINKLING	TOTAL	MAX DAY	PEAK HOUR
5000. - 10000.	306.	39007.	553.	39560.	54958.	213181.
10001. - 20000.	3239.	442600.	15971.	458570.	764109.	2622922.
20001. - 25499.	2166.	316973.	17101.	334074.	640248.	2014940.
25500. - 30000.	1989.	303401.	20941.	324342.	660498.	1996517.
30001. - 40000.	4268.	689561.	62915.	752476.	1640627.	4734517.
40001. - 49999.	3562.	619869.	75591.	695460.	1622835.	4462846.
51000. - 60000.	1930.	361182.	47598.	408780.	1037239.	2736790.
60001. - 70000.	1003.	199635.	31115.	230750.	606774.	1558994.
70001. - 80000.	438.	92574.	16709.	109283.	295563.	742398.
80001. - 90000.	206.	46014.	9404.	55418.	153070.	377389.
90001. - 99999.	119.	28059.	5320.	33378.	98530.	238387.
100000. - 125000.	143.	36909.	8186.	45095.	136245.	322560.
TOTAL	19368.	3175782.	311404.	3487186.	7710697.	22021442.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

PREDICTED RESIDENTIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
3487186.	7710697.	22021442.

REQUIREMENTS BY TYPE - ANNUAL AVERAGE

TYPE	NO. OF UNITS	GALLONS PER DAY DOMESTIC	SPRINKLING	TOTAL
METERED AND SEWERED AREAS	19368.	3175782.	311404.	3487186.
TOTAL	19368.	3175782.	311404.	3487186.

SUMMER EVAPOTRANSPIRATION (INCHES) = 13.75
SUMMER PRECIPITATION (INCHES) = 10.50
MAX. DAY EVAPOTRANSPIRATION (INCHES) = 0.29

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

TOTAL COMMERCIAL REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
2307906.	4050593.	10776715.

WATER REQUIREMENTS BY TYPE OF COMMERCIAL ESTABLISHMENT

TYPE	UNITS	NUMBER OF UNITS	MULT FACTOR	ADD FACTOR	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
					(GALLONS PER DAY)		
HOTELS	SQ. FT.	135336.	1.000	0.000	34646.	39789.	58600.
MOTELS	SQ. FT.	654721.	1.000	0.000	146658.	301826.	1014618.
BARBER SHOPS	BARBER CHAIR	64.	1.000	0.000	3485.	5125.	24829.
BEAUTY SHOPS	STATION	211.	1.000	0.000	56661.	69088.	225379.
RESTAURANTS	SEAT	7021.	1.000	0.000	169912.	585564.	1172532.
DRIVE-IN REST-NT	CAR SPACE	511.	1.000	0.000	55659.	73531.	279314.
NIGHT CLUBS	PERSON SERVED	511.	1.000	0.000	679.	679.	679.
HOSPITALS	BED	846.	1.000	0.000	277611.	466349.	771888.
NURSING HOMES	BED	622.	1.000	0.000	82685.	90767.	263597.
MEDICAL OFFICES	SQ. FT.	132562.	1.000	0.000	81923.	220053.	658833.
LAUNDRY	SQ. FT.	29415.	1.000	0.000	7442.	9589.	46181.
LAUNDROMATS	SQ. FT.	22740.	1.000	0.000	49345.	107786.	35701.
RETAIL SPACE	SALES SQ. FT.	4092311.	1.000	0.000	433785.	630216.	1109016.
BUS-RAIL DEPOTS	SQ. FT.	2757.	1.000	0.000	9182.	17923.	68935.
CAR WASHES	INSIDE SQ. FT.	17295.	1.000	0.000	82670.	178139.	544793.
CHURCHES	MEMBER	38297.	1.000	0.000	5285.	33012.	179997.
GOLF-SWIM CLUBS	MEMBER	1277.	1.000	0.000	39574.	28340.	28340.
BOWLING ALLEYS	ALLEY	94.	1.000	0.000	12564.	12564.	12564.
NEW OFFICE BLDG.	SQ. FT.	526426.	1.000	0.000	48958.	91072.	274268.
OLD OFFICE BLDG.	SQ. FT.	505000.	1.000	0.000	71710.	40905.	178770.
JAIL & PRISONS	PERSON	102.	1.000	0.000	13583.	13583.	13583.
THEATERS	SEAT	4483.	1.000	0.000	14929.	14929.	14929.
YMCA-YWCA FACIL.	PERSON	11935.	1.000	0.000	17[illegible]3.	397425.	397425.
SERVICE STATIONS	INSIDE SQ. FT.	899[illegible]9.	1.000	0.000	22570.	53052.	2832456.
APARTMENTS	UNITS	5745.	1.000	0.000	569098.	569298.	569298.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

TOTAL INDUSTRIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
4094356.	4503583.	4703538.

REQUIREMENTS BY TYPE OF INDUSTRY

ID #	INDUSTRY	NUMBER OF EMPLOYEES	PRODUCT.	EFFIC.	GALLONS/DAY ANNUAL AVERAGE	GALLONS/DAY MAXIMUM DAY	GALLONS/DAY PEAK HOUR
201	ARMOUR	287.	1.000	1.000	89728.	89728.	119622.
202	WISC BEEF	382.	1.000	1.000	39034.	39034.	163943.
203	LAND 'O LAKES	127.	1.000	1.000	29332.	29332.	29332.
204	MARIGOLD	38.	1.000	1.000	13696.	13696.	27393.
205	TOLONA PIZZA	33.	1.000	1.000	2601.	2601.	2601.
206	HOLSUM BAKERS	121.	1.000	1.000	14352.	14352.	14352.
207	COCA COLA	51.	1.000	1.000	1703.	1703.	1703.
208	WALTER BREW	38.	1.000	1.000	62913.	62913.	94369.
209	CAREER DEVELOP	289.	1.000	1.000	3248.	3248.	3248.
210	POPE & TALBOT	893.	1.000	1.000	1759487.	2168713.	2168713.
211	SHEDD BROWN	127.	1.000	1.000	20049.	20049.	20049.
212	JOHNSON LITHO	70.	1.000	1.000	5333.	5333.	5333.
213	JENNICO	7.	1.000	1.000	526.	526.	526.
214	UNIROYAL	1914.	1.000	1.000	1732036.	1732036.	1732036.
215	AM MATERIALS	127.	1.000	1.000	437.	437.	437.
216	AM. PRE-STRESS	38.	1.000	1.000	2394.	2394.	2394.
217	FEHR CONCRETE	114.	1.000	1.000	6698.	6698.	6698.
218	PHILLIPS, MAX	38.	1.000	1.000	3245.	3245.	3245.
219	PHOENIX STEEL	255.	1.000	1.000	17353.	17353.	17353.
220	GOULD	141.	1.000	1.000	24919.	24919.	24919.
221	N.W. MOTOR	51.	1.000	1.000	2650.	2650.	2650.
222	MCDONOUGH MFG	33.	1.000	1.000	489.	489.	489.
223	HUTCHENS INDSTY	26.	1.000	1.000	342.	342.	342.
224	MEMOREX	319.	1.000	1.000	261791.	261791.	261791.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

TOTAL PUBLIC-UNACCOUNTED REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
1747512.	1747512.	1747512.

REQUIREMENTS BY TYPE OF PUBLIC-UNACCOUNTED USAGE IN GALLONS PER DAY

TYPE	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
DISTRIB. LOSSES	1094896.	1094896.	1094896.
FREE SERVICES	652616.	652616.	652616.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

SUMMARY OF MUNICIPAL WATER REQUIREMENTS FOR CITY OF EAU CLAIRE, WISCONSIN

ESTIMATED WATER REQUIREMENTS FOR YEAR 1992.
(ALL VALUES IN GALLONS PER DAY)

	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
MUNICIPAL	11636961.	15860471.	30171217.
RESIDENTIAL	3487186.	7710697.	22021442.
COMMERCIAL	2307906.	4050593.	10776715.
INDUSTRIAL	4094356.	4503583.	4703538.
PUBLIC AND UNACC.	1747512.	1747512.	1747512.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 2002

ANALYZED BY MAIN SYSTEM

PREDICTED RESIDENTIAL WATER REQUIREMENTS BY CATEGORY
METERED AND SEWERED AREAS
AVERAGE ANNUAL

VALUE RANGE ($)	NO. OF UNITS	DOMESTIC	SPRINKLING	TOTAL	MAX DAY	PEAK HOUR
5000. - 10000.	373.	47457.	673.	48130.	66865.	259364.
10001. - 20000.	3940.	538483.	19431.	557914.	929644.	3191146.
20001. - 25499.	2636.	385641.	20805.	406447.	778950.	2451452.
25500. - 30000.	2420.	369129.	25478.	394607.	803587.	2429038.
30001. - 40000.	5192.	838946.	76544.	915490.	1996048.	5760191.
40001. - 49999.	4333.	754156.	91967.	846123.	1974402.	5429666.
51000. - 60000.	2348.	439427.	57910.	497337.	1261943.	3329681.
60001. - 70000.	1221.	242883.	37856.	280739.	738224.	1896731.
70001. - 80000.	533.	112629.	20329.	132958.	359593.	903229.
80001. - 90000.	250.	55982.	11441.	67423.	186231.	459145.
90001. - 99999.	144.	34137.	6472.	40609.	119875.	290031.
100000. - 125000.	174.	44904.	9960.	54864.	165761.	392439.
TOTAL	23564.	3863776.	378866.	4242641.	9381123.	26792113.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 2002

ANALYZED BY MAIN SYSTEM

PREDICTED RESIDENTIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
4242641.	9381123.	26792113.

REQUIREMENTS BY TYPE - ANNUAL AVERAGE

TYPE	NO. OF UNITS	GALLONS PER DAY DOMESTIC	SPRINKLING	TOTAL
METERED AND SEWERED AREAS	23564.	3863776.	378866.	4242641.
TOTAL	23564.	3863776.	378866.	4242641.

SUMMER EVAPOTRANSPIRATION (INCHES) = 13.75
SUMMER PRECIPITATION (INCHES) = 10.50
MAX. DAY EVAPOTRANSPIRATION (INCHES) = 0.29

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 2002

ANALYZED BY MAIN SYSTEM

TOTAL COMMERCIAL REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
2807885.	4928104.	13111356.

WATER REQUIREMENTS BY TYPE OF COMMERCIAL ESTABLISHMENT

TYPE	UNITS	NUMBER OF UNITS	MULT FACTOR	ADD FACTOR	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
					(GALLONS PER DAY)		
HOTELS	SQ. FT.	164655.	1.000	0.000	42152.	48408.	71295.
MOTELS	SQ. FT.	796558.	1.000	0.000	178429.	367213.	1234665.
BARBER SHOPS	BARBER CHAIR	78.	1.000	0.000	4240.	6236.	30208.
BEAUTY SHOPS	STATION	256.	1.000	0.000	68936.	84055.	274205.
RESTAURANTS	SEAT	8542.	1.000	0.000	296721.	712419.	1426547.
DRIVE-IN REST-NT	CAR SPACE	621.	1.000	0.000	67716.	89460.	339824.
NIGHT CLUBS	PERSON SERVED	621.	1.000	0.000	826.	826.	826.
HOSPITALS	BED	1030.	1.000	0.000	337752.	567377.	939107.
NURSING HOMES	BED	756.	1.000	0.000	100598.	110430.	320702.
MEDICAL OFFICES	SQ. FT.	161280.	1.000	0.000	99671.	267724.	801560.
LAUNDRY	SQ. FT.	35787.	1.000	0.000	9054.	11667.	56186.
LAUNDROMATS	SQ. FT.	27666.	1.000	0.000	60035.	131136.	43435.
RETAIL SPACE	SALES SQ. FT.	4978860.	1.000	0.000	527759.	766744.	1349271.
BUS-RAIL DEPOTS	SQ. FT.	3355.	1.000	0.000	11171.	21806.	83869.
CAR WASHES	INSIDE SQ. FT.	21042.	1.000	0.000	100589.	216730.	662815.
CHURCHES	MEMBER	46594.	1.000	0.000	6430.	40164.	218991.
GOLF-SWIM CLUBS	MEMBER	1553.	1.000	0.000	48147.	34479.	34479.
BOWLING ALLEYS	ALLEY	115.	1.000	0.000	15286.	15286.	15286.
NEW OFFICE BLDG.	SQ. FT.	640469.	1.000	0.000	59564.	110801.	333684.
[illegible] OFFICE BLDG.	SQ. FT.	614401.	1.000	0.000	87245.	49767.	217498.
JAIL & PRISONS	PERSON	124.	1.000	0.000	16525.	16525.	16525.
THEATERS	SEAT	5455.	1.000	0.000	18164.	18164.	18164.
YMCA-YWCA FACIL.	PERSON	14520.	1.000	0.000	21040.	483522.	483522.
SERVICE STATIONS	INSIDE SQ. FT.	109399.	1.000	0.000	27459.	64545.	3446073.
APARTMENTS	UNITS	6989.	1.000	0.000	692386.	692617.	692617.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 2002

ANALYZED BY MAIN SYSTEM .

TOTAL INDUSTRIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
4982381.	5480509.	5723568.

REQUIREMENTS BY TYPE OF INDUSTRY

ID #	INDUSTRY	NUMBER OF EMPLOYEES	PRODUCT.	EFFIC.	GALLONS/DAY ANNUAL AVERAGE	GALLONS/DAY MAXIMUM DAY	GALLONS/DAY PEAK HOUR
201	ARMOUR	349.	1.000	1.000	109111.	109111.	145463.
202	MISC BEEF	465.	1.000	1.000	47516.	47516.	199564.
203	LAND 'O LAKES	155.	1.000	1.000	35799.	35799.	35799.
204	MARIGOLD	46.	1.000	1.000	16580.	16580.	33160.
205	TOLONA PIZZA	40.	1.000	1.000	3153.	3153.	3153.
206	HOLSUM BAKERS	147.	1.000	1.000	17436.	17436.	17436.
207	COCA COLA	62.	1.000	1.000	2071.	2071.	2071.
208	WALTER BREW	46.	1.000	1.000	76158.	76158.	114236.
209	CAREER DEVELOP	352.	1.000	1.000	3956.	3956.	3956.
210	POPE & TALBOT	1087.	1.000	1.000	2141727.	2639856.	2639856.
211	SHEDD BROWN	155.	1.000	1.000	24470.	24470.	24470.
212	JOHNSON LITHO	85.	1.000	1.000	6475.	6475.	6475.
213	JENNICO	9.	1.000	1.000	676.	676.	676.
214	UNIROYAL	2329.	1.000	1.000	2107582.	2107582.	2107582.
215	AM MATERIALS	155.	1.000	1.000	533.	533.	533.
216	AM. PRE-STRESS	46.	1.000	1.000	2898.	2898.	2898.
217	FEHR CONCRETE	139.	1.000	1.000	8166.	8166.	8166.
218	PHILLIPS, MAX	46.	1.000	1.000	3928.	3928.	3928.
219	PHOENIX STEEL	310.	1.000	1.000	21095.	21095.	21095.
220	GOULD	172.	1.000	1.000	30398.	30398.	30398.
221	N.W. MOTOR	62.	1.000	1.000	3222.	3222.	3222.
222	MCDONOUGH MFG	40.	1.000	1.000	592.	592.	592.
223	HUTCHENS INDSTY	32.	1.000	1.000	421.	421.	421.
224	MEMOREX	388.	1.000	1.000	318416.	318416.	318416.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 2002

ANALYZED BY MAIN SYSTEM

TOTAL PUBLIC-UNACCOUNTED REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
2126089.	2126089.	2126089.

REQUIREMENTS BY TYPE OF PUBLIC-UNACCOUNTED USAGE IN GALLONS PER DAY

TYPE	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
DISTRIB. LOSSES	1332092.	1332092.	1332092.
FREE SERVICES	793997.	793997.	793997.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

SUMMARY OF MUNICIPAL WATER REQUIREMENTS FOR CITY OF EAU CLAIRE, WISCONSIN

ESTIMATED WATER REQUIREMENTS FOR YEAR 2002.
(ALL VALUES IN GALLONS PER DAY)

	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
MUNICIPAL	14158996.	19297478.	36708468.
RESIDENTIAL	4242641.	9381123.	26792113.
COMMERCIAL	2807885.	4928104.	13111356.
INDUSTRIAL	4982381.	5480509.	5723568.
PUBLIC AND UNACC.	2126089.	2126089.	2126089.

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

PREDICTED RESIDENTIAL WATER REQUIREMENTS BY CATEGORY
METERED AND SEWERED AREAS
AVERAGE ANNUAL

VALUE RANGE ($)	NO. OF UNITS	DOMESTIC	SPRINKLING	TOTAL	MAX DAY	PEAK HOUR
5000. - 10000.	262.E	33417.	474.	33891.	47083.	182635.
10001. - 20000.	2775.E	379179.	13682.	392862.	654620.	2247083.
20001. - 25499.	1856.E	271554.	14650.	286204.	548507.	1726218.
25500. - 30000.	1983.E	302501.	20879.	323380.	658539.	1990595.
30001. - 40000.	4255.E	687516.	62728.	750244.	1635760.	4720473.
40001. - 49999.	3551.E	618031.	75367.	693398.	1618021.	4449608.
51000. - 60000.	2356.E	440909.	58105.	499014.	1266199.	3340909.
60001. - 70000.	1225.E	243702.	37983.	281685.	740713.	1903126.
70001. - 80000.	535.E	113009.	20397.	133406.	360806.	906275.
80001. - 90000.	251.E	56171.	11480.	67651.	186859.	460694.
90001. - 99999.	145.E	34252.	6494.	40746.	120279.	291009.
100000. - 125000.	175.E	45056.	9993.	55049.	166320.	393762.
TOTAL	19368.	3225297.	332233.	3557530.	8003706.	22612387.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

PREDICTED RESIDENTIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
3557530.	8003706.	22612387.

REQUIREMENTS BY TYPE - ANNUAL AVERAGE

TYPE	NO. OF UNITS	GALLONS PER DAY DOMESTIC	SPRINKLING	TOTAL
METERED AND SEWERED AREAS	19368.	3225297.	332233.	3557530.
TOTAL	19368.	3225297.	332233.	3557530.

SUMMER EVAPOTRANSPIRATION (INCHES) = 13.75
SUMMER PRECIPITATION (INCHES) = 10.50
MAX. DAY EVAPOTRANSPIRATION (INCHES) = 0.29

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

TOTAL COMMERCIAL REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
2294186.	4074280.	10982841.

WATER REQUIREMENTS BY TYPE OF COMMERCIAL ESTABLISHMENT

TYPE	UNITS	NUMBER OF UNITS	MULT FACTOR	ADD FACTOR	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
					(GALLONS PER DAY)		
HOTELS	SQ. FT.	135336.	1.000	0.000	34646.	39789.	58600.
MOTELS	SQ. FT.	654721.	1.000	0.000	146658.	301826.	1014818.
BARBER SHOPS	BARBER CHAIR	64.	1.000	0.000	3485.	5125.	24829.
BEAUTY SHOPS	STATION	211.	1.000	0.000	56661.	69088.	225379.
RESTAURANTS	SEAT	7021.	1.000	0.000	169912.	585564.	1172532.
DRIVE-IN REST-NT	CAR SPACE	511.	1.000	0.000	55659.	73531.	279314.
NIGHT CLUBS	PERSON SERVED	511.	1.000	0.000	679.	679.	679.
HOSPITALS	BED	663.E	1.000	0.000	217466.	365313.	604656.
NURSING HOMES	BED	622.	1.000	0.000	82685.	90767.	263597.
MEDICAL OFFICES	SQ. FT.	207684.E	1.000	0.000	128349.	344755.	1032189.
LAUNDRY	SQ. FT.	29415.	1.000	0.000	7442.	9589.	46181.
LAUNDROMATS	SQ. FT.	22740.	1.000	0.000	49345.	107786.	35701.
RETAIL SPACE	SALES SQ. FT.	4092311.	1.000	0.000	433785.	630216.	1109016.
BUS-RAIL DEPOTS	SQ. FT.	2757.	1.000	0.000	9182.	17923.	68935.
CAR WASHES	INSIDE SQ. FT.	17295.	1.000	0.000	82670.	178139.	544793.
CHURCHES	MEMBER	38297.	1.000	0.000	5285.	33912.	179997.
GOLF-SWIM CLUBS	MEMBER	1277.	1.000	0.000	39574.	28340.	28340.
BOWLING ALLEYS	ALLEY	94.	1.000	0.000	12564.	12564.	12564.
NEW OFFICE BLDG.	SQ. FT.	526426.	1.000	0.000	48958.	91972.	274268.
OLD OFFICE BLDG.	SQ. FT.	505000.	1.000	0.000	31710.	40905.	178770.
JAIL & PRISONS	PERSON	102.	1.000	0.000	13582.	13582.	13582.
THEATERS	SEAT	4483.	1.000	0.000	14929.	14929.	14929.
YMCA-YWCA FACIL.	PERSON	11935.	1.000	0.000	17293.	397425.	397425.
SERVICE STATIONS	INSIDE SQ. FT.	89919.	1.000	0.000	22570.	53052.	2832456.
APARTMENTS	UNITS	5745.	1.000	0.000	569098.	569288.	569288.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

TOTAL INDUSTRIAL WATER REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
3030235.	3351017.	3501182.

REQUIREMENTS BY TYPE OF INDUSTRY

ID #	INDUSTRY	NUMBER OF EMPLOYEES	PRODUCT.	EFFIC.	GALLONS/DAY ANNUAL AVERAGE	MAXIMUM DAY	PEAK HOUR
201	ARMOUR	170.E	1.000	1.000	53149.	53149.	70856.
202	WISC BEEF	267.E	1.000	1.000	27283.	27283.	114588.
203	LAND O LAKES	127.	1.000	1.000	29332.	29332.	29332.
204	MARIGOLD	38.	1.000	1.000	13696.	13696.	27393.
205	TOLONA PIZZA	72.E	0.700	1.000	3973.	3973.	3973.
206	HOLSUM BAKERS	121.	1.000	1.000	14352.	14352.	14352.
207	COCA COLA	40.E	1.000	1.000	1336.	1336.	1336.
208	WALTER BREW	38.	1.000	1.000	62913.	62913.	94369.
209	CAREER DEVELOP	289.	1.000	1.000	3248.	3248.	3248.
210	POPE & TALBOT	700.E	1.000	1.000	1379217.	1699999.	1699999.
211	SHEDD BROWN	127.	1.000	1.000	20049.	20049.	20049.
212	JOHNSON LITHO	70.	1.000	1.000	5333.	5333.	5333.
213	JENNICO	7.	1.000	1.000	526.	526.	526.
214	UNIROYAL	1625.E	0.700	1.000	1029358.	1029358.	1029358.
215	AM MATERIALS	127.	1.000	1.000	437.	437.	437.
216	AM. PRE-STRESS	38.	1.000	1.000	2394.	2394.	2394.
217	FEHR CONCRETE	114.	1.000	1.000	6698.	6698.	6698.
218	PHILLIPS, MAX	38.	1.000	1.000	3245.	3245.	3245.
219	PHOENIX STEEL	240.E	1.000	1.000	16332.	16332.	16332.
220	GOULD	141.	1.000	1.000	24919.	24919.	24919.
221	N.W. MOTOR	51.	1.000	1.000	2650.	2650.	2650.
222	MCDONOUGH MFG	50.E	1.000	1.000	740.	740.	740.
223	HUTCHENS INDSTY	60.E	1.000	1.000	790.	790.	790.
224	MEMOREX	400.E	1.000	1.000	328264.	328264.	328264.

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

MUNICIPAL WATER REQUIREMENTS FOR THE CITY OF EAU CLAIRE, WISCONSIN FOR THE YEAR 1992

ANALYZED BY MAIN SYSTEM

TOTAL PUBLIC-UNACCOUNTED REQUIREMENTS IN GALLONS PER DAY

ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
1486475.	1486475.	1486475.

REQUIREMENTS BY TYPE OF PUBLIC-UNACCOUNTED USAGE IN GALLONS PER DAY

TYPE	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
DISTRIB. LOSSES	975250.E	975250.E	975250.E
FREE SERVICES	511225.E	511225.E	511225.E

NOTE: DEFAULT = PROJECTION BY POPULATION
E = EXTERNAL PROJECTION BY DIRECT INPUT
H = HISTORICAL TREND EXTRAPOLATION

SUMMARY OF MUNICIPAL WATER REQUIREMENTS FOR CITY OF EAU CLAIRE, WISCONSIN

ESTIMATED WATER REQUIREMENTS FOR YEAR 1992.
(ALL VALUES IN GALLONS PER DAY)

	ANNUAL AVERAGE	MAXIMUM DAILY	PEAK HOURLY
MUNICIPAL	10368426.	14814602.	29423283.
RESIDENTIAL	3557530.	8003706.	22612387.
COMMERCIAL	2294186.	4074260.	10982841.
INDUSTRIAL	3030235.	3251017.	3501182.
PUBLIC AND UNACC.	1486475.	1486475.	1486475.

```
****************************************
*                                      *
*                                      *
* I W R   M A I N   S Y S T E M        *
*                                      *
*                                      *
****************************************
```

SUMMARY OF PROJECTED MUNICIPAL WATER REQUIREMENTS

FOR CITY OF

EAU CLAIRE, WISCONSIN

RUN NO.	YEAR	MEAN ANNUAL	MAX DAY	PEAK HOUR
		GALLONS PER DAY		
1	1982	9118515.	12426991.	23637275.
2	1992	11636961.	15860471.	30171217.
3	2002	14158996.	19297478.	36708468.
4	1992	10368426.	14814602.	29423283.

APPENDIX B

LIBRARY OF WATER USAGE COEFFICIENTS
(ABRIDGED)

```
!CONSTANT
 E011 205.0          E012 1.246          E013 -0.467
 E021 28.9           E022 1.576          E023 33.6
 E031 30.2           E032 39.5           E041 39.2
 E042 35.5           E051 0.42           E052 1496.95
 E053 -0.703         E054 0.429          E061 0.441
 E062 0.164          E063 -0.793         E064 2.93
 E065 -1.57          E066 1.45           E071 0.41
 E072 44.573         E073 0.783          E081 0.441
 E082 0.164          E083 -0.793         E084 2.93
 E085 -1.57          E086 1.45           E091 0.41
 E092 100.           E093 -0.783         E094 2.93
 E095 -1.57          E096 1.45           E101 0.803
 E102 -1.26          E111 2227.34        E112 2.06
 E113 0.413          E121 0.0147         E122 0.118
 E123 -10.4          E124 -1.25          E125 0.931
 E131 1609.59        E132 0.943          E133 0.523
 E141 0.0147         E142 0.118          E143 -10.4
 E144 -1.25          E145 0.931          E151 1609.59
 E152 0.943          E153 0.523          E154 1.25
 E155 0.931          E161 334.0          E162 2.017
 ENDD
!EVAPTRAN
 LATD 47.        LONG 85.        RAIN 9.         EVAP 13.
 LATD 46.        LONG 85.        RAIN 9.         EVAP 13.
 LATD 45.        LONG 85.        RAIN 8.         EVAP 13.
 LATD 44.        LONG 85.        RAIN 7.         EVAP 14.
 LATD 43.        LONG 85.        RAIN 7.         EVAP 14.
 LATD 42.        LONG 85.        RAIN 9.         EVAP 14.
 LATD 41.        LONG 85.        RAIN 9.         EVAP 15.
 LATD 40.        LONG 85.        RAIN 8.         EVAP 15.
 LATD 47.        LONG 86.        RAIN 8.         EVAP 13.
 LATD 46.        LONG 86.        RAIN 9.         EVAP 13.
 LATD 45.        LONG 86.        RAIN 7.         EVAP 14.
 LATD 44.        LONG 86.        RAIN 7.         EVAP 14.
 LATD 43.        LONG 86.        RAIN 8.         EVAP 14.
 LATD 42.        LONG 86.        RAIN 10.        EVAP 14.
 LATD 41.        LONG 86.        RAIN 10.        EVAP 15.
 LATD 40.        LONG 86.        RAIN 8.         EVAP 15.
 LATD 48.        LONG 87.        RAIN 7.         EVAP 12.
 LATD 47.        LONG 87.        RAIN 7.         EVAP 13.
 LATD 46.        LONG 87.        RAIN 9.         EVAP 14.
 LATD 45.        LONG 87.        RAIN 9.         EVAP 14.
 LATD 44.        LONG 87.        RAIN 8.         EVAP 15.
 LATD 43.        LONG 87.        RAIN 8.         EVAP 15.
 LATD 42.        LONG 87.        RAIN 11.        EVAP 15.
 LATD 41.        LONG 87.        RAIN 11.        EVAP 16.
 LATD 40.        LONG 87.        RAIN 10.        EVAP 16.
 LATD 48.        LONG 88.        RAIN 10.        EVAP 12.
```

LATD 47.	LONG 88.	RAIN 8.	EVAP 13.
LATD 46.	LONG 88.	RAIN 8.	EVAP 14.
LATD 45.	LONG 88.	RAIN 9.	EVAP 14.
LATD 44.	LONG 88.	RAIN 9.	EVAP 15.
LATD 43.	LONG 88.	RAIN 9.	EVAP 14.
LATD 42.	LONG 88.	RAIN 10.	EVAP 15.
LATD 41.	LONG 88.	RAIN 12.	EVAP 16.
LATD 40.	LONG 88.	RAIN 9.	EVAP 16.
LATD 49.	LONG 89.	RAIN 11.	EVAP 12.
LATD 48.	LONG 89.	RAIN 11.	EVAP 12.
LATD 47.	LONG 89.	RAIN 10.	EVAP 12.
LATD 46.	LONG 89.	RAIN 10.	EVAP 13.
LATD 45.	LONG 89.	RAIN 9.	EVAP 13.
LATD 44.	LONG 89.	RAIN 9.	EVAP 13.
LATD 43.	LONG 89.	RAIN 10.	EVAP 14.
LATD 42.	LONG 89.	RAIN 12.	EVAP 15.
LATD 41.	LONG 89.	RAIN 12.	EVAP 16.
LATD 40.	LONG 89.	RAIN 10.	EVAP 16.
LATD 49.	LONG 90.	RAIN 11.	EVAP 12.
LATD 48.	LONG 90.	RAIN 11.	EVAP 12.
LATD 47.	LONG 90.	RAIN 11.	EVAP 12.
LATD 46.	LONG 90.	RAIN 11.	EVAP 13.
LATD 45.	LONG 90.	RAIN 10.	EVAP 13.
LATD 44.	LONG 90.	RAIN 11.	EVAP 13.
LATD 43.	LONG 90.	RAIN 12.	EVAP 14.
LATD 42.	LONG 90.	RAIN 14.	EVAP 15.
LATD 41.	LONG 90.	RAIN 13.	EVAP 16.
LATD 40.	LONG 90.	RAIN 10.	EVAP 16.
LATD 39.	LONG 90.	RAIN 9.	EVAP 17.
LATD 38.	LONG 90.	RAIN 8.	EVAP 18.
LATD 37.	LONG 90.	RAIN 9.	EVAP 18.
LATD 36.	LONG 90.	RAIN 9.	EVAP 19.
LATD 35.	LONG 90.	RAIN 7.	EVAP 19.
LATD 34.	LONG 90.	RAIN 9.	EVAP 19.
LATD 33.	LONG 90.	RAIN 10.	EVAP 19.
LATD 32.	LONG 90.	RAIN 9.	EVAP 19.
LATD 31.	LONG 90.	RAIN 14.	EVAP 19.
LATD 30.	LONG 90.	RAIN 14.	EVAP 19.
LATD 29.	LONG 90.	RAIN 16.	EVAP 20.
LATD 49.	LONG 91.	RAIN 12.	EVAP 12.
LATD 48.	LONG 91.	RAIN 12.	EVAP 12.
LATD 47.	LONG 91.	RAIN 12.	EVAP 12.
LATD 46.	LONG 91.	RAIN 12.	EVAP 13.
LATD 45.	LONG 91.	RAIN 10.	EVAP 13.
LATD 44.	LONG 91.	RAIN 11.	EVAP 14.
LATD 43.	LONG 91.	RAIN 13.	EVAP 14.
LATD 42.	LONG 91.	RAIN 15.	EVAP 14.
LATD 41.	LONG 91.	RAIN 13.	EVAP 15.
LATD 40.	LONG 91.	RAIN 10.	EVAP 17.
LATD 49.	LONG 92.	RAIN 12.	EVAP 12.

LATD 43.	LO . 92.	RAIN 12.	EVAP 12.
LATD 47.	LONG 92.	RAIN 13.	EVAP 12.
LATD 46.	LONG 92.	RAIN 14.	EVAP 13.
LATD 45.	LONG 92.	RAIN 11.	EVAP 14.
LATD 44.	LONG 92.	RAIN 10.	EVAP 14.
LATD 43.	LONG 92.	RAIN 17.	EVAP 15.
LATD 42.	LONG 92.	RAIN 17.	EVAP 15.
LATD 41.	LONG 92.	RAIN 10.	EVAP 16.
LATD 40.	LONG 92.	RAIN 10.	EVAP 16.
LATD 49.	LONG 93.	RAIN 12.	EVAP 13.
LATD 48.	LONG 93.	RAIN 12.	EVAP 13.
LATD 47.	LONG 93.	RAIN 14.	EVAP 13.
LATD 46.	LONG 93.	RAIN 14.	EVAP 14.
LATD 45.	LONG 93.	RAIN 12.	EVAP 14.
LATD 44.	LONG 93.	RAIN 11.	EVAP 15.
LATD 43.	LONG 93.	RAIN 15.	EVAP 15.
LATD 42.	LONG 93.	RAIN 15.	EVAP 15.
LATD 41.	LONG 93.	RAIN 10.	EVAP 16.
LATD 40.	LONG 93.	RAIN 10.	EVAP 16.
LATD 50.	LONG 94.	RAIN 12.	EVAP 14.
LATD 49.	LONG 94.	RAIN 12.	EVAP 14.
LATD 48.	LONG 94.	RAIN 12.	EVAP 14.
LATD 47.	LONG 94.	RAIN 14.	EVAP 14.
LATD 46.	LONG 94.	RAIN 14.	EVAP 15.
LATD 45.	LONG 94.	RAIN 13.	EVAP 16.
LATD 44.	LONG 94.	RAIN 12.	EVAP 16.
LATD 43.	LONG 94.	RAIN 10.	EVAP 16.
LATD 42.	LONG 94.	RAIN 9.	EVAP 16.
LATD 41.	LONG 94.	RAIN 10.	EVAP 16.
LATD 40.	LONG 94.	RAIN 11.	EVAP 17.
LATD 50.	LONG 95.	RAIN 12.	EVAP 14.
LATD 49.	LONG 95.	RAIN 12.	EVAP 14.
LATD 48.	LONG 95.	RAIN 12.	EVAP 14.
LATD 47.	LONG 95.	RAIN 13.	EVAP 14.
LATD 46.	LONG 95.	RAIN 13.	EVAP 15.
LATD 45.	LONG 95.	RAIN 13.	EVAP 15.
LATD 44.	LONG 95.	RAIN 12.	EVAP 16.
LATD 43.	LONG 95.	RAIN 10.	EVAP 16.
LATD 42.	LONG 95.	RAIN 10.	EVAP 16.
LATD 41.	LONG 95.	RAIN 11.	EVAP 17.
LATD 40.	LONG 95.	RAIN 17.	EVAP 17.
LATD 50.	LONG 96.	RAIN 11.	EVAP 14.
LATD 49.	LONG 96.	RAIN 12.	EVAP 14.
LATD 48.	LONG 96.	RAIN 12.	EVAP 14.
LATD 47.	LONG 96.	RAIN 11.	EVAP 14.
LATD 46.	LONG 96.	RAIN 12.	EVAP 15.
LATD 45.	LONG 96.	RAIN 12.	EVAP 15.
LATD 44.	LONG 96.	RAIN 9.	EVAP 16.
LATD 43.	LONG 96.	RAIN 11.	EVAP 16.
LATD 42.	LONG 96.	RAIN 10.	EVAP 16.

LATD 41.	LONG 96.	RAIN 12.	EVAP 17.
LATD 40.	LONG 96.	RAIN 13.	EVAP 18.
LATD 50.	LONG 97.	RAIN 10.	EVAP 14.
LATD 49.	LONG 97.	RAIN 11.	EVAP 14.
LATD 48.	LONG 97.	RAIN 12.	EVAP 14.
LATD 47.	LONG 97.	RAIN 12.	EVAP 14.
LATD 46.	LONG 97.	RAIN 12.	EVAP 15.
LATD 45.	LONG 97.	RAIN 10.	EVAP 15.
LATD 44.	LONG 97.	RAIN 12.	EVAP 16.
LATD 43.	LONG 97.	RAIN 10.	EVAP 16.
LATD 42.	LONG 97.	RAIN 10.	EVAP 16.
LATD 41.	LONG 97.	RAIN 13.	EVAP 17.
LATD 40.	LONG 97.	RAIN 13.	EVAP 18.
LATD 50.	LONG 98.	RAIN 9.	EVAP 14.
LATD 49.	LONG 98.	RAIN 10.	EVAP 14.
LATD 48.	LONG 98.	RAIN 10.	EVAP 14.
LATD 47.	LONG 98.	RAIN 10.	EVAP 14.
LATD 46.	LONG 98.	RAIN 9.	EVAP 15.
LATD 45.	LONG 98.	RAIN 8.	EVAP 15.
LATD 44.	LONG 98.	RAIN 9.	EVAP 16.
LATD 43.	LONG 98.	RAIN 11.	EVAP 15.
LATD 42.	LONG 98.	RAIN 11.	EVAP 15.
LATD 41.	LONG 98.	RAIN 11.	EVAP 17.
LATD 40.	LONG 98.	RAIN 13.	EVAP 17.
LATD 50.	LONG 99.	RAIN 8.	EVAP 14.
LATD 49.	LONG 99.	RAIN 8.	EVAP 14.
LATD 48.	LONG 99.	RAIN 8.	EVAP 14.
LATD 47.	LONG 99.	RAIN 8.	EVAP 14.
LATD 46.	LONG 99.	RAIN 8.	EVAP 15.
LATD 45.	LONG 99.	RAIN 7.	EVAP 15.
LATD 44.	LONG 99.	RAIN 8.	EVAP 15.
LATD 43.	LONG 99.	RAIN 9.	EVAP 15.
LATD 42.	LONG 99.	RAIN 10.	EVAP 15.
LATD 41.	LONG 99.	RAIN 10.	EVAP 16.
LATD 40.	LONG 99.	RAIN 14.	EVAP 11.
LATD 40.	LONG 99.	RAIN 14.	EVAP 17.
LATD 50.	LONG 100.	RAIN 8.	EVAP 14.
LATD 49.	LONG 100.	RAIN 8.	EVAP 14.
LATD 48.	LONG 100.	RAIN 9.	EVAP 14.
LATD 47.	LONG 100.	RAIN 9.	EVAP 14.
LATD 46.	LONG 100.	RAIN 9.	EVAP 15.
LATD 45.	LONG 100.	RAIN 7.	EVAP 15.
LATD 44.	LONG 100.	RAIN 8.	EVAP 15.
LATD 43.	LONG 100.	RAIN 10.	EVAP 15.
LATD 42.	LONG 100.	RAIN 10.	EVAP 16.
LATD 41.	LONG 100.	RAIN 10.	EVAP 16.
LATD 40.	LONG 100.	RAIN 14.	EVAP 16.
LATD 50.	LONG 101.	RAIN 7.	EVAP 14.
LATD 49.	LONG 101.	RAIN 7.	EVAP 14.
LATD 48.	LONG 101.	RAIN 9.	EVAP 14.

```
 LATD 47.        LONG 101.        RAIN 10.        EVAP 14.
 LATD 46.        LONG 101.        RAIN 7.         EVAP 15.
 LATD 45.        LONG 101.        RAIN 7.         EVAP 15.
 LATD 44.        LONG 101.        RAIN 8.         EVAP 15.
 LATD 43.        LONG 101.        RAIN 10.        EVAP 16.
 LATD 42.        LONG 101.        RAIN 12.        EVAP 15.
 LATD 41.        LONG 101.        RAIN 13.        EVAP 15.
 LATD 40.        LONG 101.        RAIN 9.         EVAP 16.
 LATD 50.        LONG 102.        RAIN 7.         EVAP 14.
 LATD 49.        LONG 102.        RAIN 7.         EVAP 14.
 LATD 48.        LONG 102.        RAIN 7.         EVAP 14.
 LATD 47.        LONG 102.        RAIN 7.         EVAP 15.
 LATD 46.        LONG 102.        RAIN 7.         EVAP 15.
 LATD 45.        LONG 102.        RAIN 6.         EVAP 15.
 LATD 44.        LONG 102.        RAIN 6.         EVAP 16.
 LATD 43.        LONG 102.        RAIN 8.         EVAP 15.
 LATD 42.        LONG 102.        RAIN 9.         EVAP 15.
 LATD 41.        LONG 102.        RAIN 10.        EVAP 15.
 LATD 40.        LONG 102.        RAIN 9.         EVAP 15.
 LATD 50.        LONG 103.        RAIN 6.         EVAP 14.
 LATD 49.        LONG 103.        RAIN 6.         EVAP 14.
 LATD 48.        LONG 103.        RAIN 6.         EVAP 15.
 LATD 47.        LONG 103.        RAIN 5.         EVAP 15.
 LATD 46.        LONG 103.        RAIN 6.         EVAP 15.
 LATD 45.        LONG 103.        RAIN 6.         EVAP 16.
 LATD 44.        LONG 103.        RAIN 6.         EVAP 15.
 LATD 43.        LONG 103.        RAIN 7.         EVAP 15.
 LATD 42.        LONG 103.        RAIN 8.         EVAP 15.
 LATD 41.        LONG 103.        RAIN 8.         EVAP 15.
 LATD 40.        LONG 103.        RAIN 8.         EVAP 15.
 LATD 50.        LONG 104.        RAIN 5.         EVAP 14.
 LATD 49.        LONG 104.        RAIN 5.         EVAP 14.
 LATD 48.        LONG 104.        RAIN 5.         EVAP 15.
 LATD 47.        LONG 104.        RAIN 6.         EVAP 15.
 LATD 46.        LONG 104.        RAIN 6.         EVAP 15.
 LATD 45.        LONG 104.        RAIN 6.         EVAP 16.
 LATD 44.        LONG 104.        RAIN 7.         EVAP 15.
 LATD 43.        LONG 104.        RAIN 6.         EVAP 15.
 LATD 42.        LONG 104.        RAIN 6.         EVAP 15.
 LATD 41.        LONG 104.        RAIN 7.         EVAP 15.
 LATD 40.        LONG 104.        RAIN 8.         EVAP 15.
 ENDD
!COMLABEL
 BARB BARBER SHOPS     BEUT BEAUTY SHOPS     DPOT BUS-RAIL DEPOTS
 CARW CAR WASHES       CHUR CHURCHES         CLUB GOLF-SWIM CLUBS
 BOWL BOWLING ALLEYS   COLG COLLEGES RESID.  HOSP HOSPITALS
 HOTL HOTELS           LNDM LAUNDROMATS      LNDY LAUNDRY
 MEDL MEDICAL OFFICES  MOTL MOTELS           MOVI DRIVE-IN MOVIES
 NURS NURSING HOMES    OFFN NEW OFFICE BLDG. OFFO OLD OFFICE BLDG.
 JAIL JAIL & PRISONS   EATN RESTAURANTS      EATO DRIVE-IN REST-NT
```

```
 NITE NIGHT CLUBS      SALE RETAIL SPACE     SKLL SCHOOL,ELEM.
 SKLH SCHOOL, HIGH     THTR THEATERS         YMCA YMCA-YWCA FACIL.
 GASS SERVICE STATIONS C001 APARTMENTS
 ENDD
1COMMUNIT
 BARB BARBER CHAIR     BEUT STATION          DPOT SQ. FT.
 CARW INSIDE SQ. FT.   CHUR MEMBER          CLUB MEMBER
 BOWL ALLEY            COLG STUDENT          HOSP BED
 HOTL SQ. FT.          LNDM SQ. FT.          LNDY SQ. FT.
 MEDL SQ. FT.          MOTL SQ. FT.          MOVI CAR STALL
 NURS BED              OFFN SQ. FT.          OFFO SQ. FT.
 JAIL PERSON           EATN SEAT             EATO CAR SPACE
 NITE PERSON SERVED    SALE SALES SQ. FT.    SKLL STUDENT
 SKLH STUDENT          THTR SEAT             YMCA PERSON
 GASS INSIDE SQ. FT.   C001 UNITS
 ENDD
1COMMAVES      EXPECTED USAGE VALUES
 BARB    54.6          BEUT    269.          CARW    4.78
 CHUR    .138          CLUB    31.0          COLG    106.
 HOSP    328.003       HOTL    .256          LNDY    .253
 BOWL    133.          MOTL    .224          MOVI    5.0
 NURS    133.          OFFO    .142          JAIL    133.
 EATN    24.2          NITE    1.33          SALE    .106
 SKLL    5.38          SKLH    6.63          THTR    3.33
 YMCA    1.449         GASS    .251          LNDM    2.17
 EATO    109.          DPOT    3.33          C001    99.067
 OFFN    .093          MEDL    .618
 ENDD
1COMMAXDY      EXPECTED USAGE VALUES
 BARB    80.3          BEUT    328.          CARW    10.3
 CHUR    .862          CLUB    22.2          COLG    114.
 HOSP    551.          HOTL    .294          LNDY    .326
 BOWL    133.          MOTL    .461          MOVI    5.33
 NURS    146.          OFFO    .081          JAIL    133.
 EATN    83.4          NITE    1.33          SALE    .154
 SKLL    9.68          SKLH    19.6          THTR    3.33
 YMCA    33.3          GASS    .590          LNDM    4.74
 EATO    144.          DPOT    6.5           C001    99.1
 OFFN    .173          MEDL    1.66
 ENDD
1COMMPEAK      EXPECTED USAGE VALUES
 BARB    389.          BEUT    1070.         CARW    31.5
 CHUR    4.79          CLUB    22.2          COLG    250.
 HOSP    912.          HOTL    .403          LNDY    1.57
 BOWL    133.          MOTL    1.55          MOVI    5.33
 NURS    424.          OFFO    .354          JAIL    133.
 EATN    167.          NITE    1.33          SALE    .271
 SKLL    49.1          SKLH    121.          THTR    3.33
 YMCA    37.3          GASS    31.5          LNDM    1.57
 EATO    547.          DPOT    25.0          C001    99.1
```

```
 OFFN     .521          MEDL     4.97
 ENDD
1INDLABEL
 I201 ARMOUR           I202 WISC BEEF        I203 LAND 'O LAKES
 I204 MARIGOLD         I205 TOLONA PIZZA     I206 HOLSUM BAKERS
 I207 COCA COLA        I208 WALTER BREW      I209 CAREER DEVELOP
 I210 POPE & TALBOT    I211 SHEDD BROWN      I212 JOHNSON LITHO
 I213 JENNICO          I214 UNIROYAL         I215 AM MATERIALS
 I216 AM. PRE-STRESS   I217 FEHR CONCRETE    I218 PHILLIPS, MAX
 I219 PHOENIX STEEL    I220 GOULD            I221 N.W. MOTOR
 I222 MCDONOUGH MFG    I223 HUTCHENS INDSTY  I224 MEMOREX
 ENDD
1INDAVAVE
 I201          312.640 I202          102.184 I203          230.960
 I204          360.430 I205           78.830 I206          118.610
 I207           33.400 I208         1655.600 I209           11.240
 I210         1970.310 I211          157.870 I212           76.180
 I213           75.090 I214          904.930 I215            3.440
 I216           63.010 I217           58.750 I218           85.400
 I219           68.050 I220          176.730 I221           51.970
 I222           14.810 I223           13.170 I224          820.660
 ENDD
1INDMXDAY
 I201          312.640 I202          102.184 I203          230.960
 I204          360.430 I205           78.830 I206          118.610
 I207           33.400 I208         1655.600 I209           11.240
 I210         2428.570 I211          157.870 I212           76.180
 I213           75.090 I214          904.930 I215            3.440
 I216           63.010 I217           58.750 I218           85.400
 I219           68.050 I220          176.730 I221           51.970
 I222           14.810 I223           13.170 I224          820.660
 ENDD
1INDPEKHR
 I201          416.800 I202          429.170 I203          230.960
 I204          720.860 I205           78.830 I206          118.610
 I207           33.400 I208         2483.400 I209           11.240
 I210         2428.570 I211          157.870 I212           76.180
 I213           75.090 I214          904.930 I215            3.440
 I216           63.010 I217           58.750 I218           85.400
 I219           68.050 I220          176.730 I221           51.970
 I222           14.810 I223           13.170 I224          820.660
 ENDD
1PUBCOFAA
 LOSS 14.9             FSER 5.2              AIRP 5.0
 P001 5.0
 ENDD
1PUBCOFMD
 LOSS 14.9             FSER 5.2              AIRP 5.0
 P001 5.0
 ENDD
```

```
!PUBCOFFH
 LOSS 14.0            FSER 5.2            AIRP 5.0
 P001 5.0
 ENDD
!PUBLABEL
 LOSS DISTRIB. LOSSES  FSER FREE SERVICES    AIRP AIRPORTS
 P001 P001 USER
 ENDD
 ENDI
```

APPENDIX C

COMPUTATIONAL EQUATIONS

Definition of Symbols and Subscripts

Symbol	Meaning of Symbol	Units
q	water usage for a particular category	gpd
V	average home value in a range of values = $\frac{Vmin + Vmax}{2 \times 1000}$	thousands of dollars
$Vmin$	lower limit of home value range	dollars
$Vmax$	upper limit of home value range	dollars
N_r	the number of residences of value range r	residences
F_a	assessment factor	none
L	gross residential land area, including streets	acres
H_d	housing density, N_r/L	units/acres
B	irrigable land per dwelling	acres/unit
D_p	population density in residences	persons/unit
$\bar{p}$	mean annual price of water	cents/thousand gallons
p_s	summer price of water	cents/thousand gallons
E	total summer evapotranspiration	inches
R	total summer precipitation	inches
E_m	maximum day evapotranspiration = = 0.25 for west = 0.29 for east	inches
P_c	commercial usage parameter	parameter units
C	commercial usage coefficient	gpd/parameter
U	industrial water usage per employee in an industry	gpd/employee
P_n	industrial population in industry	employees
M	public-unaccounted usage coefficient	gpcd
P_{pu}	public-unaccounted parameter	persons

Subscript	Quantity Indicated
pkhr	peak-hour quantities
mxdy	maximum-day quantities
D	domestic water usage
s	sprinkling water usage
ms	meter-sewered residences
fs	flat-rate sewered residences
mt	metered septic tank residences
ft	flat-rate septic tank residences
mxs	maximum day sprinkling
pks	peak hour sprinkling
n	industrial usage category
pu	public-unaccounted usage category
w	west of the 100th meridian
e	east of the 100th meridian
c	category of commercial usage

Residential Equations

1. Mean annual domestic usage

$$(q_D)_{ms} = (206 + 3.47\ V/F_a - 1.3\ \bar{p})N_r \quad (1)$$

$$(q_D)_{fs} = (28.9 + 4.39\ V/F_a + 33.6\ D_p)N_r \quad (2)$$

$$(q_D)_{mt} = (30.2 + 39.5\ D_p)N_r \quad (3)$$

$$(q_D)_{ft} = (30.2 + 39.5\ D_p)N_r \quad (4)$$

2. Mean annual sprinkling usage

$$(q_s)_{ms,w} = (0.48 \times 1130\ p_s^{-0.703}\ (V/F_a)^{0.429})N_r \quad (5)$$

$$(q_s)_{ms,e} = (0.39 \times 0.164B^{-0.793}\ (E-0.6R)^{2.93}\ p_s^{-1.57}(V/F_a)^{1.45})N_r \quad (6)$$

$$(q_s)_{fs} = (0.41 \times 100\ (V/F_a)^{0.789})N_r \quad (7)$$

$$(q_s)_{mt} = (0.39 \times 0.164B^{-0.793}(E-0.6R)^{2.93}\ p_s^{-1.57}\ (V/F_a)^{1.45})N_r \quad (8)$$

$$(q_s)_{ft} = (0.41 \times 100(V/F_a)^{0.789})N_r \quad (9)$$

where

$$B = 0.803\ H_d^{-1.26} \quad (10)$$

3. Maximum day sprinkling usage

$$(q_{mxs})_{ms,w} = (3400\ E_m^{2.06}\ (V/F_a)^{0.413})N_r \quad (11)$$

$$(q_{mxs})_{ms,e} = (0.0106B^{0.118}E_m^{-10.4} \quad (12)$$
$$p_s^{-1.25}(V/F_a)^{0.931})N_r$$

$$(q_{mxs})_{fs} = (2750B^{0.943}(V/F_a)^{0.523})N_r \quad (13)$$

$$(q_{mxs})_{mt} = (0.0106B^{0.118}E_m^{-10.4} \quad (14)$$
$$p_s^{-1.25}(V/F_a)^{0.931})N_r$$

$$(q_{mxs})_{ft} = (2750B^{0.943}(V/F_a)^{0.523})N_r \quad (15)$$

4. Peak hour usage (single equation for all four categories)

$$q_{pkhr} = 334\,N_r + 2.017\,(q_D + q_{mxs}) \quad (16)$$

Commercial Equations

$$\bar{q}_c = \bar{C}\,P_c \quad (17)$$

$$(q_c)_{mxdy} = C_{mxdy}P_c \quad (18)$$

$$(q_c)_{pkhr} = C_{pkhr}P_c \quad (19)$$

Industrial Equations

$$\bar{q}_n = \bar{U}_n P_n \quad (20)$$

$$(q_n)_{mxdy} = (U_n)_{mxdy}P_n \quad (21)$$

$$(q_n)_{pkhr} = (U_n)_{pkhr}P_n \quad (22)$$

Public-Unaccounted Equations

$$\bar{q}_{pu} = \bar{M}_{pu}P_{pu} \quad (23)$$

$$(q_{pu})_{mxdy} = (M_{pu})_{mxdy} P_{pu} \quad (24)$$

$$(q_{pu})_{pkhr} = (M_{pu})_{pkhr} P_{pu} \quad (25)$$

END

FILMED

3-85

DTIC